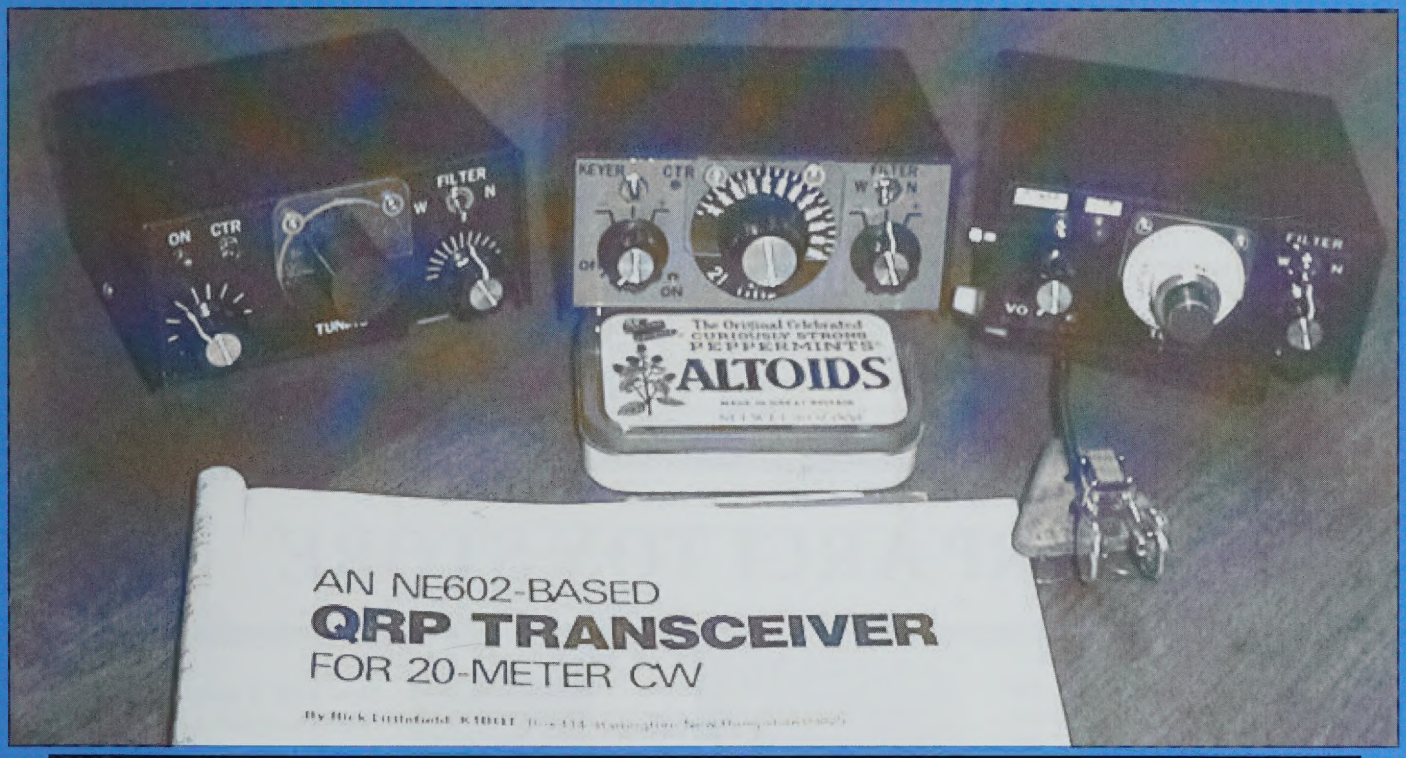
July 2000
$4.95

QRP Quarterly

Journal of the QRP Amateur Radio Club, International

July 2000 Volume XXXX Number 3



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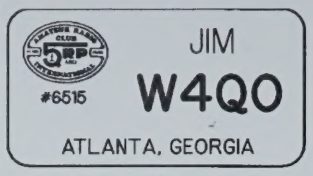

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You can win a one year membership or renewal to the QRP ARCI.Quarterly Just send your entry photo for the cover picture contest to the managing editor.

THE THRILL IS BACK!

Everyone is invited to check the QRP ARCI web pages at http://www.qrparci.org/

Jim Stafford, W4QO, QRP ARCI Webmeister

QRP ARCI TOY STORE

The QRP-ARCI mouse pad has been tested under rigorous conditions. It excels at high speed clicking and browsing. It is a blue logo with a champagne background. Mouse and browsers not included

The Official QRP-ARCI Coffee Mug. Used by the top QRP Fox Hunters, contesters and casual operators found on or near the normal QRP freqs. The Mug has a Kelly green logo on a white cup. Coffee, tea or milk not included.

The New QRP-ARCI patches are full stitched, black on white. They measure 3-9/16" wide x 2-1/2" high oval, and can either be ironed on, or sewn on the finest evening wear!

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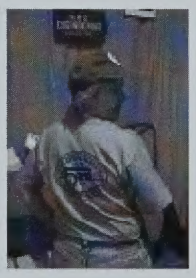

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QRP QUARTERLY

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From the Editor's Desk

Mary Cherry, NA6E
8383 Sierra Sunset Drive, Sacramento, CA 95828-5304 email: na6e@arrl.net

It's hard to believe it's time for another issue of the QQ. I have to make a brief mention of what a wonderful time I had in Dayton. It was a pleasure to meet some of the QRP "heroes", connect with old friends and make some new friends. The first person I ran across was Mike Branca , W3IRZ (one of my heroes). What a way to start the 4 days! The speakers on Thursday were exceptional and informational. I'm trying to keep this brief, but if you haven't been to one of the large Hamventions, you really need to do so. And to clear up any misconceptions . . . the security guard was helping me find the QRP-ARCI booth on Friday morning . . really!!!

72 de NA6E

I used to envy those running QRP,
Whose QSL's sported a DXCC.

Now with 200 plus,
I see that power is not a must.

Life is short, you see,
So enjoy it more with QRP!

Larry Wilson, KF0N

FRANK LEE, G3YCC, SK

Frank was an oddball, one of those people that you loved or hated there was no in between! The sometimes dreaded email of 'check my web pages' became an almost instant switch off until you recognized where Frank came from.

His love of both QRP and the Internet gave him life after retirement that many of us miss. I well remember going to his club in Hull to give a talk on QRP. They all sat there, listened carefully and then asked Frank if it was all true!

Luckily it was. We didn't always see 'eye to eye' but I amongst many other QRPers will miss Frank for his forthrightness and above all else his web pages. Full of information given without thought just to spread the word.

Having sat at his dining table for dinner with his delightful wife I can only say that QRP life will be a little sadder with the passing of Frank Lee, G3YCC. SK.

Dick Pascoe, G0BPS

Welcome to QRP ARCI

QRP Amateur Radio Club International, an organization begun in the early 60s has grown to over 10,000 members. The club is international in nature with members all over the world. Club members like to build and/or operate small, low powered rigs. Most of our members are not against high power and as a group we have never advocated the elimination of amplifiers or high powered contacts. We simply enjoy operating at low power levels - lower than we were used to operating. Why? Because it's FUN!

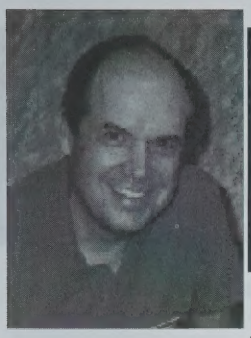
We have found that there is a real thrill associated with low power contacts. Because low power rigs are relatively easy to build, we have also found that an even greater thrill results from operating a rig that we have built ourselves. Accordingly, there are a lot of technical folks in the club who enjoy talking about new ways to build small transceivers/receivers/transmitters. Finding parts and sharing sources with others is a way of enjoying QRP as well. In fact, most all of our members get very excited about helping others who may be new to building or operating QRP.

Why join our club? Here are some of the benefits of being a member of QRP ARCI:
1. The QRP Quarterly - This journal is published each quarter in an 8 1/2 x 11 format and is usually 60-70 pages in length. It is packed with technical content but also has something for everyone from rank beginner to seasoned veteran.
2. QRP Awards program - Numerous awards are offered by the club. By the way, these are available for non-members as well as members. The most popular is the 1000 miles per watt. Simply take your output power and divide by the miles between the two stations.
3. QRP Contests - Again, you do not have to be a member to enter out contests. If you are a member, you send your club number. If not, send your power output instead. The standard exchange of the RST and State/Province/Country precedes this information. The contests are very informal and you won't find much in the way of "hogging" frequencies and that sort of thing. They may be thought of as a way to test out your rigs and antennas with other QRPers. Don't own a QRP rig? Well, simply turn your power down on your "big" transceiver as much as you can and have a go at it.
4. Local club support - We try to help local/regional clubs with their programs by promotion and assistance. We also try to have our officers and board members at as many hamfests per year as possible. We bring along or send out a box of materials and promo items for use at hamfests as well.
5. Dayton Four Days In May - The club sponsors a huge event each year in conjunction wit the Dayton Hamvention. We actually add a full day of seminars before the hamfest and we have a whole program of activities each evening of the hamfest. You'll find almost a QRP Hamfest at the Days Inn South Dayton motel where we take over most of the facility.
6. QRP Forum online- A place to ask questions, trade ideas, seek information, make friends, in short - have fun! Check it out.

There are many more reasons to join. Take a tour of our web site. Thank you for visiting us and "try QRP, you'll like it!" **THE THRILL IS BACK!**

ABOUT THE COVER: It has been 10 years since "The QRP-15 CW Transceiver " article by Rick Littlefield*, appeared in the September 1990 issue of CQ Magazine, and that article inspired me to build and operate my first QRP transceiver. Over the years I have built and modified 10 of these radios and they have provided me with hours of building and operating enjoyment. Etched circuit boards are still being sold by Far Circuits.

73's Angelo Drammissi ,K3YUN
adramis @aol.



Base Current—

Jim Stafford, W4QO
Club President
email: w4qo@arrl.net

The thrill is back! **FDIM 2000** - Holy Cow, how could you ask for anything more? Record numbers of QRPers gathered at the newly renovated (and renamed) Ramada Inn. Here are just a few of the records set: 398 QRPers (a record) registered for at least one activity at our "QRP motel", 210 registered for the FDIM seminar Thursday (a record), 218 paid at the banquet (a record), $5000 in prizes (thanks Scott Rosenfeld and Leonard Young for this record), 153 ARCI subscriptions - new and renewals (a record), 9 outstanding speakers in a dual track program (a record), a record lowest voltage (1.5v) design ever in a QRP transceiver contest (actually 4 entries in this category—G4FDV won 1st place), Wayne Burdick speaker at banquet for 2nd time (a record - for Wayne!), long sleeved commemorative tee shirts sold out (a record - it had to be - it was the first time we have had a collector tee shirt for an event), and lastly Doug Hendricks, KI6DS, set a record (he said he'd never won anything before, so it's a record first prize for Doug) by winning the first Elecraft K-1 awarded at a QRP function (of course, it had only been announced one day before Dayton!)

Thom WI8W (our official press photog) took over 200 pictures, some of which appear in this issue and they all appear on the club web site. I've probably left out so many things, but you get the idea. Plans have started for FDIM2001. If you have input, send or email comments to W4DU@arrl.net

QRP ARCI Hall of Fame -

No record was set here as only 2 candidates were inducted into the Hall of Fame, but they were great selections. Mike Bryce, WB8VGE, who for years served as Membership Chairman of our club and also was a long time correspondent in 73 magazine with his QRP column, was selected. He was also responsible for perpetuating the Hot Water Handbook which is on almost every serious QRPer's shelf.

Also, Joe Everhart, N2CX, who has had a submittal in this journal every issue for around 10 years, was selected. Joe is a popular speaker at FDIM and is also a spark plug in the NJ QRP Club. He also writes a column on "testing" for QQ and is a great "explainer". No wonder he was selected. Congratulations fellows.

Celticon2000

Marilyn and I will be attending George's QRP festivities in Ireland around Labor Day. We are looking forward to this event and also to touring the country where we have never been. I also look forward to spending a few days touring in G-land and visiting the great QRP Mecca - G3RJV's shack if we are worthy to cross the threshold there! I want to confirm that he actually has a spectrum analyzer. He told the crowd a story at Dayton that would make every QRPer green with envy, if envy weren't a sin, of course!

QQ Staff

I want to thank Mary Cherry, NA6E, and all the others who work on this publication for their efforts in making it the outstanding document that it is each quarter. I get many, many compliments on it as I roam around to the hamfests.

I know of a couple changes this past quarter - Ed Tanton, N4XY, has come on board as the Technical Editor. Welcome aboard, Ed. Also, Doc Lindsey, K0EVZ, has had to let go of the QRP Clubhouse for health reasons. We appreciate the work that Doc did and wish him a solid strengthening in the days ahead. Les Shattuck, K4NK, will be taking over the Clubhouse column after this issue. Randy Foltz, K7TQ, has been onboard for a couple quarters but I just wanted to say thanks for all he has done with our Contest Branch and the web pages he built and maintains where you may now send in your scores ONLINE. Much appreciated. Remember that back copies of QQ are available from K3TKS for a couple years back. I know members appreciate being able to get those copies if they miss an issue for some reason.

On the Internet

There have been many changes to the web site of late. Of special note is that now you may retrieve your expiration date for QQ online. You also get your club member number if you forgot it. I should say though that it is not real-time in terms of being totally "up to the minute." It runs about a month behind at times. So please don't bother Mark if your info is a couple week's out of date!

And yes, our membership drive - **2k in 2k** is going very well, thank you. We have seen our numbers pass the 1500 active subscribers this quarter, well on our way to 2000 paid up. Remember to look for friends who are not members or paid up members and "sponsor" them into or back into the club. You might win a big prize if you do. Check the web site, see the JOIN page. Several enhancements were also made to the forum - QRP-F - this past quarter. It's easier to find things and you may now attach a picture or graphic to your messages. Check it out and post some news of your activities. Try it.

Some personal activities

I picked up the customary QRP kits at Dayton this year bringing me to a new record number of unbuilt kits! I grabbed the BLT tuner from NorCal (I already have an unbuilt SMK-1), the Ft. Smith Keyer, and a NorCal dipole antenna - Gary Diana had these for a buck - can't beat the cost per db, can you?

I have taken a break from the CQ WPX contest this afternoon to prepare this column. Using the **QRP-Cub™** transceiver for 15m and an 80 meter horizontal loop at 40 feet, I have made 20 contacts in about an hour and a half. I need a JA and a VK to have WAC during this contest.

I'm using the TR-Log software that I brought home from Dayton. I had used other software in the past, but switched to K7TR's since his software supports our QRP ARCI contests. It's taking a bit of getting used to (especially since I didn't read the manual before the contest) but I am catching on. Sure neat to see my old 286 laptop keying that little Cub on the operating table in front of the TS940 and Heath linear sitting idle (for a long time now.) I like to feed the audio into the Radio Shack DSP amplifier and have the sound fill the room! It makes me seem like I'm running a KW!

I will be in the Hootowl Sprint later this evening but may snag a couple more new countries with the Cub beforehand. Oh, I know, 20 QSOs isn't many but when you are using that little Cub (at 1.2 watts) or any QRP rig, it's as much fun for me now as 200 contacts used to be with the big rig. You see - that's why -

The Thrill is Back!

de Jim, W4QO

IDEA EXCHANGE

Technical tidbits for the QRPer

Mike Czuhajewski WA8MCQ 7945 Citadel Drive, Severn, MD 21144 wa8mcq@erols.

IN THIS EDITION OF THE IDEA EXCHANGE

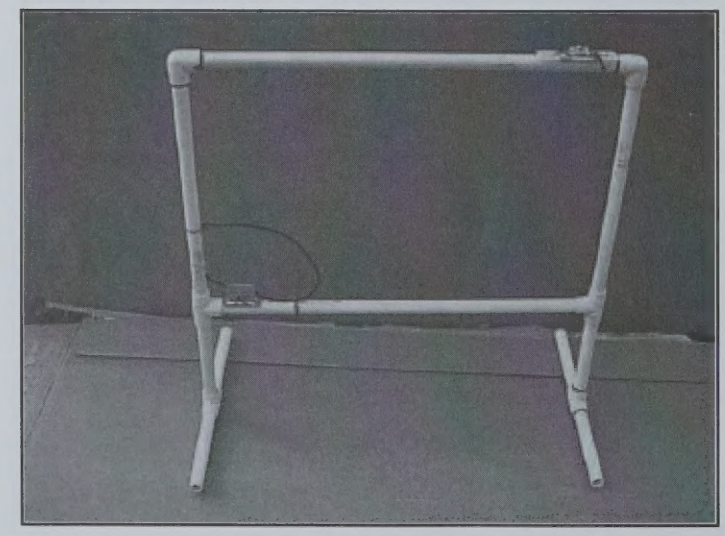
The "Long Title" loop antenna, N2CX
Devices to hold SMT parts, N5IB & KD7S
Curing VFO drift, W1HUE
Use soda straws to find cause of VFO drift, W3TS
Source for new 365 pF variable capacitors, WA8MCQ
Keeping toroids in their place, W1HUE
PCB pattern for SWR indicator, N7MOB
AM modulated signal source, W4LJD
QRP Online

THE "LONG TITLE" LOOP ANTENNA

Just inducted into the QRP Hall of Fame this year, ***Joe Everhart, N2CX*** *of Brooklawn, NJ has been supplying the Idea Exchange with an unending string of his "technical quickies" for years. Although he missed an issue or three in the early days, he's been quite regular over the years and, this one is #34! (Graphics were done by N2CX.)*

This Quickie is in response to a request for more info on an antenna I have shown off at several recent NJQRP meetings and Atlanticon 2000. I had never intended for it to be taken seriously, but apparently there is no end to the amount of interest that QRPers will show in antennas no matter how impractical…

The antenna was built as part of a rig for a combined construction and operating competition held at Pacificon during fall of 1999. The rig was displayed along with the antenna at the above events and written up in the winter 2000 QRP Homebrewer journal. Actually the formal name for the rig was the **N2CX-Why-Did-I-Ever-Commit-To-This-How-Will-I-Ever-Finish-It-In-Time-And-Still-Keep-My-Job-And-Family-Obligations-PVC-Gusher-Loop-The-Loop-Rainbow-Tuna-Tin-2-Fireball-40-TiCK-Keyer-Ugly-Weekender-Fifield/Meachemized-With-MRX-Technology-1999-Pacificon-Building-And-Operating-Contest-Entry** which I will abbreviate to "long title" for brevity.



The rationale for making the loop was that I wanted a table-top antenna for use in an indoor "fox hunt" with the following guidelines:

1. Good 50 ohm load for transmitter
2. Better radiation than dummy load for short range operation
3. Had to fit in lug-along suitcase
4. Build from available materials in one evening
5. Look plausible but perhaps a little outrageous

Since it had to fit in carry-on luggage the maximum external dimensions had to be limited to no more than 12x18 inches for the suitcase I intended to use. This is the partially disassembled size since I added feet to make it stand up on a table. See the photo in Figure 1 for a view of the completed antenna.

Some calculations using a G4FGQ program called RJELOOP2.EXE (see reference at end) gave the bad news about its performance. Data for a single-turn of 14 Ga. wire of the given dimensions resonates at 7 MHz with a 320-pf capacitor, has a bandwidth of about 20 kHz and an efficiency of about .08%.

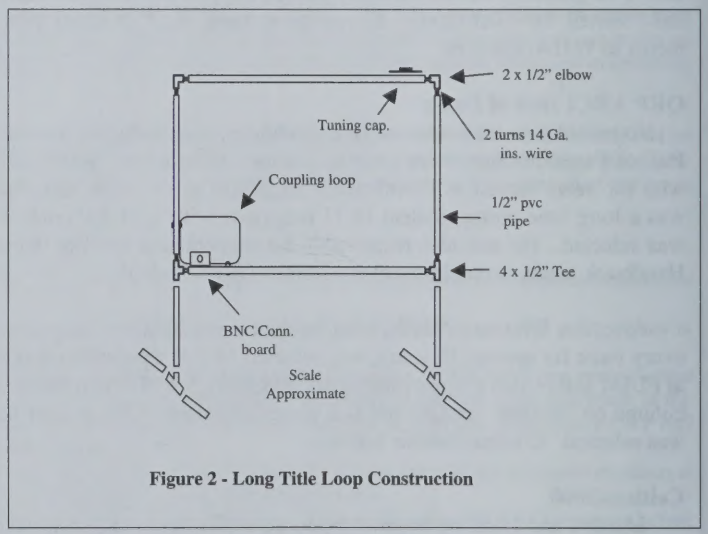


Figure 2 - Long Title Loop Construction

Not having a variable capacitor that large, I used a two-turn loop to resonate with a 120-pf compression mica trimmer that was on hand. This loop "should" be a higher Q configuration though it is still about 5 S-units down from a decent skywire.

Figure 2 is an exploded view showing how the loop was built. In keeping with guideline No. 3 from above, the structural pieces are all ½ inch PVC pipe. Individual pipe pieces are not dimensioned on the drawing since they were cut to fit the maximum 12x18 inch limitation. The "feet" were simply cut to about 6 inches since they are removed for packing so aren't affected by the "packed" size restrictions.

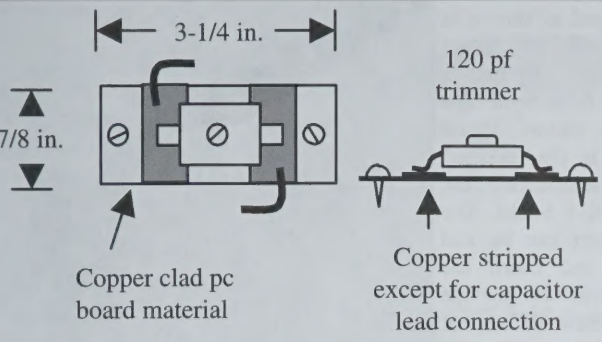


Figure 3 - Tuning capacitor board

Additional assemblies had to be built for the tuning capacitor and BNC connector mounting. Figures 3 and 4 show this detail. They are nothing but available scraps of copper-clad printed circuit board material cut as shown. The tuning capacitor board needed isolated areas where the two ends of the trimmer cap were soldered on. Copper foil between these two areas was scored with an Xacto ™ knife and peeled off using needle-nosed pliers. Each assembly was attached to the PCV pipe in the proper location using sheet metal screws.

Two turns of 14 Ga. stranded insulated wire make up the loop conductor. One end of the wire passes through a small hole

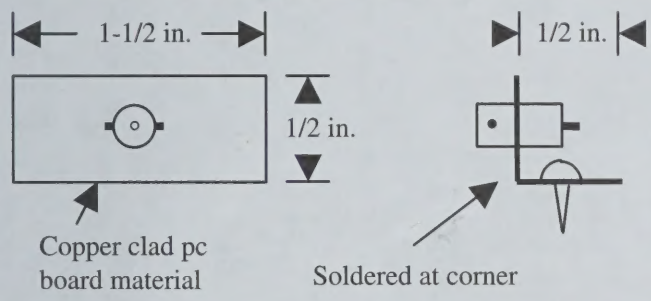


Fig 4 - BNC connector board

drilled in the upper right-hand corner of the loop frame for connection to the tuning capacitor. The wire then passes through the whole upper rectangle of pipe twice (you will find this an interesting proposition since the wire is stiff so threading it through the pipe becomes an assembly/disassembly process at each corner) and finally passes through a second hole for the final connection to the trimmer capacitor. What you end up with is a parallel tuned circuit whole inductor is the two-turn loop tuned by the compression mica cap.

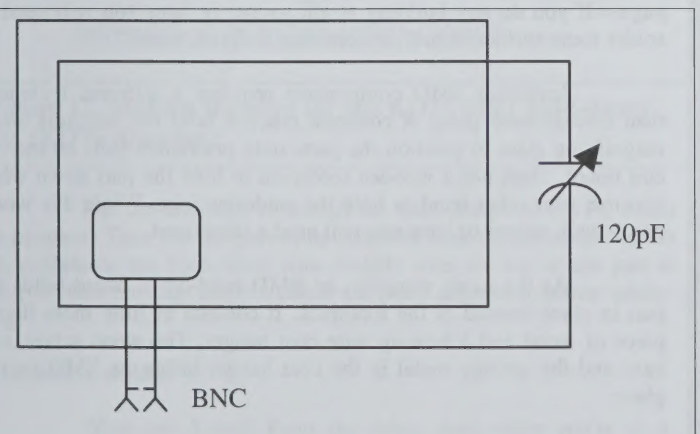


Figure 5 - Loop schematic diagram

The coupling loop is simply a small loop of the same wire placed diagonally opposite the tuning capacitor. This helps maintain electrical symmetry for some degree of electrostatic noise rejection. There is no physical connection between the main loop and this coupling loop. Figure 5 shows that the antenna is basically a parallel resonant circuit with a coupling loop coupled magnetically to it.

For single-turn loops the usual rule of thumb is that the coupling loop is about 1/5 the size of the tuned loop. I had no idea what the ratio was for a two-turn loop so an empirical determination was made. The first trial used about 18 inches of wire connected to the BNC connector. An Autek RF-1 was connected to the coupling loop through a couple of feet of RG-58 and the main loop was tuned to about 7040 kHz. The SWR was over 2:1 at resonance. The small loop size was then decreased an inch I length and SWR re-checked. Fortunately it went down! Successive one inch decreases were made until the resonant SWR was gotten below 1.5:1 with a coupling loop circumference of 15 inches. The coupling loop is held in place by two plastic Ty-raps ™.

The best thing I can say for the loop is that it did its intended job. The fox pelt was obtained with ease. Obviously the "long title" loop is very inefficient. During testing the night before Pacificon (naturally I finished it just in time) showed that I could hear 40 meter signals including a Canadian military HF radar but signals were very weak. Tuning is awfully critical, too. Even with a steady hand and an insulated tuning tool it takes a couple of minutes to set up properly. And if it is jostled, tuning changes. A couple of tries at "real" on-the–air contacts have been less than satisfactory. The very next time I hear a QRP signal that is 20 dB over S-9 I'll try again.

Why would anyone want to build one? I dunno! It does have a certain cuteness factor and QRPers really enjoy a challenge so maybe somebody could convince himself that it would be fun to try out. On the other hand it would be ideal for some short-range 40 meter operation where a reliable antenna with intentionally limited radiation properties is desired.

References:

1. "Just Good Enough Construction", Joe Everhart, QRP Homebrewer, Winter 2000, pp 40-47
2. PA3CQR "Magnetic Loop Antenna" web page http://www.iri.tudelft.nl/~geurink/magnloop.htm

—DE N2CX

DEVICES TO HOLD SMT PARTS

In an article elsewhere in this issue I described the SMK-1 transceiver kit from NorCal. The whole idea of the kit is to be a learning tool for developing the skills needed to work with surface mount parts. Part of the challenge can be holding the tiny things in place before soldering them. There have been a number of nifty little devices made to do that; here are some ideas and photos from a pair of web pages, used with permission of the authors. These two pages are also linked from the NorCal web page, which is at

http://www.fix.net/~jparker/norcal.html

Go down the page a bit and click on ***SMD Component***

Hold Down Jigs and such. *That will take you to another page that will link you to both of these pages, as well as a third not shown here. Also, if you go down the NorCal page a bit farther you'll find a link to* ***A brief introduction to prototyping with Surface Mount Technology (SMT)*** *by Luke Enriquez VK3EM.*

The first hold-down device is from the web page of ***N5IB, Jim Giammanco;*** *you can also go directly to the SMT part of his web page at:*

http://www.qsl.net/n5ib/page3.html

Figure 6 is a version of a hold-down jig I built from a description by **Steve "Melt Solder" Weber, KD1JV**. The spring is actually an antenna salvaged from a toy walkie talkie.

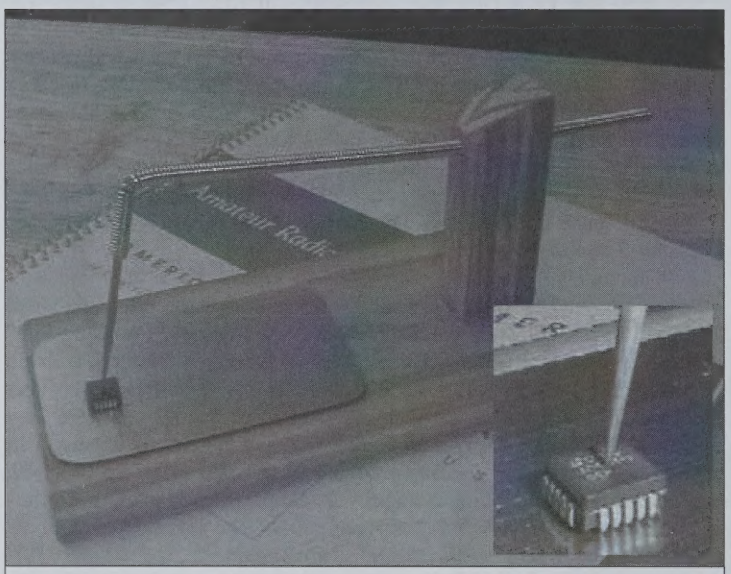


Figure 6. SMT holder built by N5IB from a description given by KD1JV. (N5IB photo.)

In a QRP-L post on 4/28/00 Mahlon, N4EEE, described a "goofy-lookin' goose-shaped SMD holder-downer doofus" to ease the positioning of SMT parts. Here's my implementation in figure 7; the 2N2222A is for scale. It works great! The weight is a lead sinker, the legs are music wire, and the business end is a piece of bamboo skewer shaped as shown in the closeup, figure 8, and hot-glued to the music wire. The next picture, figure 9, is the "doofus" in action on the SMK-1 board. The weight can be slid up and down the skewer to provide different amounts of hold-down force. I use just enough so the part won't be pulled by the wicking action of the solder. Too much force and you can "squirt" parts everywhere. Another "doofus" with a concave tip will work with those cylindrical diodes in the SMK-1.

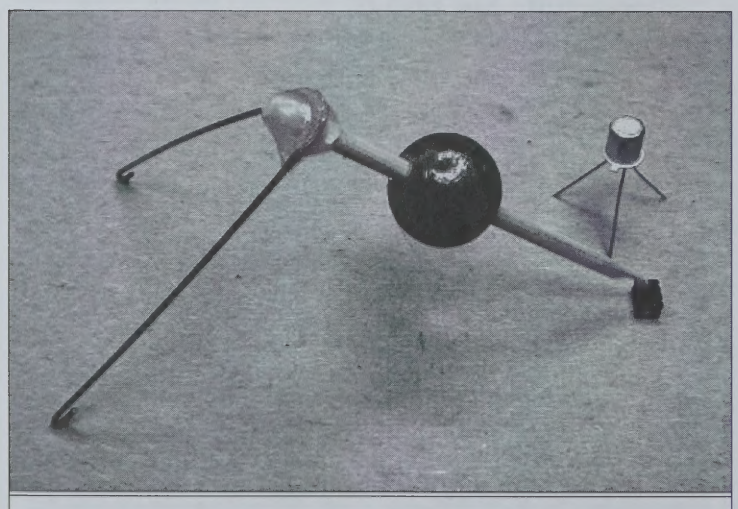


Figure 7. SMT "doofus" holder built by N5IB. (N5IB photo.)

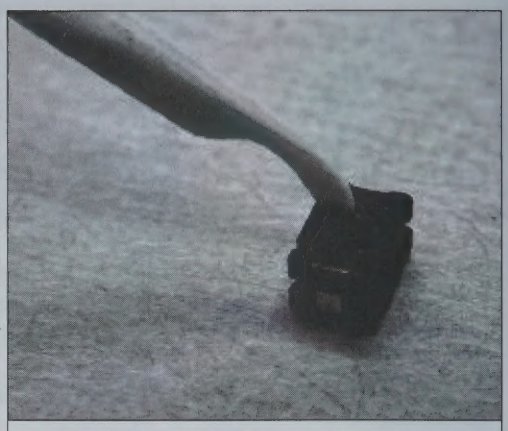


Figure 8. Business end of the "doofus." (N5IB photo.)

—DE N5IB

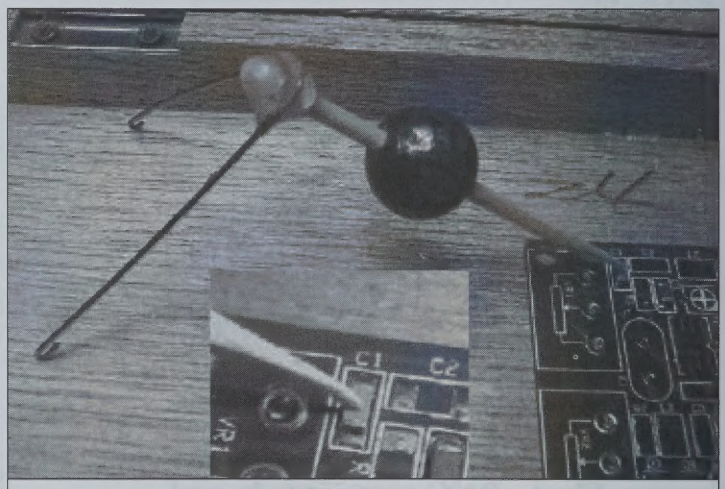


Figure 9. "Doofus" in action on the SMK-1 board. (N5IB photo.)

Next, from ***Bill Jones, KD7S of Sanger, CA and his web page—***If you do any building at all, sooner or later you will need to solder some surface mount devices onto a circuit board.

Installing SMD components requires a different technique than through-hole parts. A common practice is to use tweezers and a magnifying glass to position the parts onto pre-tinned pads on the circuit board. Then use a wooden toothpick to hold the part down while you use your other hand to hold the soldering iron. While this works pretty well, sooner or later you will need a third hand.

As the name suggests, an SMD hold-down board holds the part in place instead of the toothpick. It consists of little more than a piece of wood and a bent-up wire coat hanger. The wood serves as a base and the springy metal in the coat hanger holds the SMD part in place.

This simple, homebrew device shown in figure 10 can make life in the land of Lilliput a lot less stressful, especially for those of us who have exceeded our "best used by" date by several years.

Construction

I cut the base from a scrap of 3/8" thick particle board. It measures six inches square. Next I cut a shallow groove down the center of the board (figure 11) to hold the coat hanger in place. The groove should be just wide enough to accommodate the thickness of the wire hanger. Although I used a table saw to make the cuts, a hand saw should work just fine.

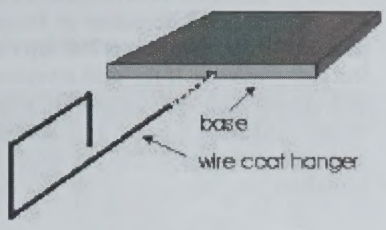


Figure 10. KD7S SMT hold-down jig. (KD7S drawing)

The hanger is cut and bent to shape using ordinary pliers. The dimensions are not critical. (See figure 12.)

Use a file to round the end of the wire that holds the components down. Finish the job with some fine sandpaper or steel wool. The end of the wire should be smooth and fairly blunt.

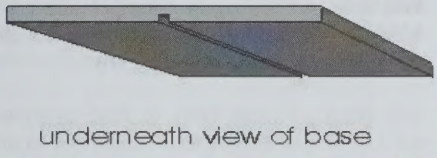


Figure 11. Underside of base (KD7S drawing).

Installation and use

Slide the long side of the wire as far as it will go into the slot in the bottom of the base. Depending upon the springiness of the wire you may want to bend it up or down a little. The objective is to have just enough pressure to hold the device in place, but no more.

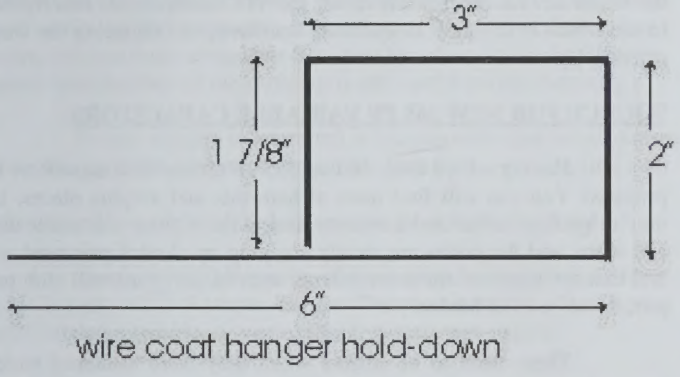


Figure 12. Making the wire for the KD7S SMT hold-down jig. (KD7S drawing)

Lift the hold-down wire off the base and place the PC board in position. Then lay the part to be soldered onto its pre-tinned solder pads. Release the hold-down wire directly over the top of the part to keep it from moving. Double check the part's alignment before soldering.

The deluxe model

What can I say? Paint the thing. And while you're at it, scrape the rust off the coat hanger before you bend it up. Hey, go wild and put some rubber feet on the bottom of the board. Use press-on letters to put your name and call sign on the base. What the heck --- go down to K- Mart and buy an aluminum travel case for it. The sky's the limit here.

—DE KD7S

CURING VFO DRIFT—IT AIN'T ALWAYS EASY!

*From **Larry East, W1HUE** of Idaho Falls, Idaho—*

Reducing temperature drift of a "simple" VFO can be a tedious and frustrating process. For a given transceiver model, some owners will experience significant warm-up frequency drift, whereas others will see very little drift. Such variations are not unexpected due to normal production tolerances of the parts used in the VFO. It is therefore not uncommon for a mod that makes your rig drift-free only providing marginal results for a supposedly identical rig owned by your buddy.

The obvious sources of drift in a VFO are the inductor(s) and capacitors used in the resonant circuit. Slug tuned inductors (and inductors wound on powdered iron toroids) usually have a positive temperature coefficient, causing the oscillator frequency to decrease with temperature. Most capacitors have a negative temperature coefficient, so the proper choice of capacitor size(s) and type(s) will almost exactly compensate the temperature drift of such an inductor. Air wound inductors should have negligible temperature drift.

If a tuning diode is used in place of a variable capacitor, it can also contribute to drift. A tuning diode can be temperature compensated by using an appropriate series diode and shunt resistor, but the usual approach is to reduce its influence on frequency drift by making it a small part of the total circuit capacitance. Active components in the VFO can also contribute to drift due to chance in capacitance with temperature, but with bipolar transistors and FETs, this effect can be made very small by proper circuit design. In simple QRP transmitter/transceiver designs, an active mixer (such as an NE602/612) is often used as the VFO oscillator. Unfortunately, the thermal properties of '602/612 mixers vary from device to device making it almost impossible to come up with a drift cure that will work for everyone. For this and other reasons, it is preferable to use a separate FET or bipolar oscillator for the VFO active device.

If you want to try to reduce the drift in a VFO, here are a few things to keep in mind:

—You won't be able to make any meaningful drift measurements immediately after touching a soldering iron to the rig. Let it sit with the power OFF for at least 30 minutes (preferably an hour) before making drift measurements.

—Some transmitter designs use "down conversion", meaning that the output frequency drift is in the opposite direction to the VFO drift.

—Some capacitor types – especially ceramic caps that have sat in a parts bin for a few years – need to be "conditioned" for several minutes to an hour or more in an operating circuit before they completely stabilize.

—The best way to check for drift is with a frequency counter. You can also monitor the VFO on another receiver, but this is less precise. In any event, make sure that your measuring device is relatively stable; trying to check for VFO drift using a receiver that also drifts is a rather hopeless endeavor!

Here's some information on the drift characteristics and availability of some common types of capacitors:

NP0 caps have a temperature coefficient that is ideally zero,

but in practice they may exhibit small positive or negative coefficients (more likely negative in my experience), typically less than ±100 PPM/deg-C. C0G caps are the same as NP0; C0G is an "EIA" designation for NP0 type. Most parts suppliers (Mouser, Digi-Key, etc.) carry a large variety of NP0/C0G capacitors, both "monolithic" and disk.

"Nxxx" on a capacitor specifies the nominal negative change in capacitance with temperature: N750 means -750 PPM/deg-C, N1500 means -1500 PPM/deg-C, etc. The value is not exact and there will be some variation between capacitors carrying the same designation. These types may also carry an "EIA" designation; the more common ones are:

P2G – N150

T2H – N470

U2J – N750

P3K – N1500

Nxxx disk ceramics may also be designated by a colored dot on the top:

Black – NP0

Red – N075

Orange – N150

Blue – N470

Violet – N750

Digi-Key carries Philips N750 ceramic disk capacitors having a specified temperature coefficient of (1000 ± 120) PPM/deg-C. Other Nxxx caps can often be found in capacitor assortments from surplus dealers and in Radio Shack capacitor assortments. They are also sometimes available from Dan's Small Parts.

WA8MCQ note—That's Danny Stevig, KA7QJY, who has been providing parts to homebrewers for over ten years. He has an extensive online catalog which can be seen by way of the NorCal QRP club web site. The URL for the catalog is

http://www.fix.net/~jparker/dans.html

Polystyrene capacitors have a negative temperature coefficient of 150 PPM/deg-C. These caps are physically larger than ceramic caps and are easily damaged by heat. Do not confuse these with polypropylene capacitors which, although designated as "stable", do not usually have a specified temperature coefficient. Mouser carries an assortment of polystyrene caps.

Silver mica capacitors are often referred to as "high stability capacitors", but they do have a small positive temperature coefficient. In fact, silver micas are about the only commonly available capacitors that have a reproducible and fairly linear positive (but usually unspecified) temperature coefficient. They suffer very little from aging effects; hence they are "highly stable". Silver mica caps can be obtained from Mouser and Dan's Small Parts.

You may occasionally find disk ceramic caps marked "P100" indicating that they have a positive 100 PPM/deg-C. temperature coefficient (these may also be marked with a white dot on top).

X7R, X7U etc. capacitors should not be used in a VFO even though they are usually listed as "temperature stable". They have low temperature drift around room temperature, but their drift can be positive or negative at extended temperatures.

Z5U caps should ***never*** be used in frequency determining circuits; they are intended for coupling and bypass use only.

To tackle VFO drift, here's a technique that usually works for me. If your VFO decreases in frequency during warm-up, replace a poly or NP0 cap with an N750 cap of the same value and see what effect that produces. If the drift reverses direction, experiment with combinations of NP0 and Nxxx caps (with the same total capacitance value as the original). If the drift is still negative but smaller, look for another capacitor to change. If there is no change, then you replaced the wrong capacitor!

If your VFO increases in frequency during warm-up, replace a poly cap with an equal value NP0. If the drift direction reverses, try combinations of NP0 and poly (or Nxxx) caps. If it is still positive, try silver mica caps in combination with NP0 (or poly) caps. If the drift is positive and no poly caps are used, replace a Nxxx cap with an NP0 or an NP0 with a silver mica and see what happens.

With enough persistence and a sufficiently large assortment of NP0, Nxxx and silver mica capacitors, you should eventually find some combination that reduces the drift to an acceptable level. What is "acceptable" may well be influenced by your level of patience! If all else fails, put the rig in a temperature controlled enclosure! (I'm only kidding—but a temperature controlled enclosure might be something to consider for a really stable VFO.)

—DE W1HUE

USE SODA STRAWS TO FIND CAUSE OF VFO DRIFT

Here's another VFO drift tip passed to me in person by long time QRPer **Mike Michael, W3TS** of Halifax, PA. As we often do, we ran into each other at a local hamfest near Baltimore and the discussion drifted to VFOs (no pun intended). Mike mentioned a handy trick that he's used for years; he admitted that he can't remember if he dreamed this one up himself or read it somewhere, but it's still pretty useful. He takes a soda straw and blows gently on one component in the VFO while listening to the tone in a receiver, to see how much it drifts from the warm air. He repeats this on all the VFO components one by one, to see which is the most temperature sensitive, and replacing the worst offender(s).

SOURCE FOR NEW 365 PF VARIABLE CAPACITORS

Having a hard time finding 365 pF air variable capacitors for projects? You can still find them at hamfests and surplus places, but they're getting harder and harder to find, a lot of them are rather dirty and worn, and the prices are slowly creeping up. And if you need several that are identical for some reason, such as doing a small club project, it can be even harder.

There used to be a time when they were scattered widely across the landscape, in millions of AM radios and stereo systems, as well as virtually every catalog that had anything electronic in it. Unfortunately, technology has marched on to give us electronic tuning—something we even use a lot in QRP rigs now—and these venerable parts are not made any longer.

Although it's a bit pricey for my tastes, there is a source of new ones, recently made. The organization is the Xtal Set Society, a group devoted to crystal radio sets in various forms. Not only do they have a number of books, newsletters and parts devoted to the subject, they have 365 pF air variable capacitors. They were concerned that the surplus market had pretty well dried up, so they went out and had some made! A bit expensive, perhaps, but at least they ARE available, and they're fresh and new, not stiff and bent and dirty like a lot of the ones at hamfests. And since they had them made, they're all identical. That can be important if you're going to do a club project and need uniformity. Figure 13 shows what they look like.

You can write to them at P.O. Box 3026, St. Louis, MO 63130, or visit their web page at:

www.midnightscience.com

Go to the bottom of the opening page, click on BOOKSTORE, then page down a bit and click on Crystal Radio Kits. The variable cap (just one type available) is right at the top of that page--365 pF for $10.95. Us old timers find that a large number of dollars for something that used to be "cheap" at one time, or at least cost a much smaller number of dollars—but they ARE available and they are fresh. These have 31 plates total, 0.010" spacing, and a 5/8" long ¼" diameter shaft. They are also said to have slotted end rotor blades, which allows you to make slight adjustments in the tuning range by bending them in or out a bit.

Figure 13. Picture of the 365 pF variable cap from the web page.

Being an old-timer going back to 1964 when I got my first license at age 14, I have a bit of a problem with paying almost $11 for a variable capacitor like this since I remember what they used to cost. It's sort of like the old guy who remembers when bread was only a nickel a loaf, but forgets to mention that hardly anyone had a nickel!

But are they really all that expensive for new parts—not surplus—especially one that is no longer produced by the millions and has low demand? To give a little perspective, I went to an online consumer price index calculator and plugged the numbers into it to see what that would translate into in 1970 dollars, and came up with $2.48--and that sounds about right for back then. Don't forget, when comparing prices from earlier days you do have to consider inflation. So these things aren't really all that expensive after all, everything considered. Don't forget, this is a once-ubiquitous item that has almost completely disappeared from the face of the earth but is still useful in homebrewing.

In case anyone is interested in playing with that calculator to figure the equivalent prices of some other ham items, you can find it at:

http://woodrow.mpls.frb.fed.us/economy/calc/cpihome.html

Another possible source of these capacitors is Antique Electronic Supply, 6221 S Maple Avenue, Tempe, AZ 85283. They have a paper catalog available, or you can look at their web page at

http://www.tubesandmore.com/

Under their variable capacitor section on the web page they list a 365 pF unit which may or may not be the same as the one from the Xtal Set Society. The price is $9.95. They also have a number of items that may be of interest, including a lot of tubes, mostly "new old stock" (NOS) that come with guarantees. Among other things, they have the ancient 2A6 tube which appears to be a somewhat suitable replacement for the detector tube in the Boonton 260A Q meter (a handy piece of test equipment I've written about before).

—DE WA8MCQ

KEEPING TOROIDS IN THEIR PLACE

From long time QRP Quarterly author and staff member ***Larry East, W1HUE*** *of Idaho Falls, Idaho*—Have you ever felt the need to secure a toroid inductor to a circuit board? Or wanted to keep the wire on it from moving due to mechanical vibration? You undoubtedly have if you do much home brewing or kit building. I've seen many suggested adhesives to use for this purpose, ranging from the old favorite "Q-Dope" to "Shoe-Goop". I have used Q-Dope, but I find that it tends to become brittle after awhile and the toroid can come lose. (I've seen many posts on QRP-L claiming that clear finger nail polish is essentially the same as Q-Dope and works well, but I have never tried it.) I've also used hot-glue and RTV sealant, but both can be difficult to remove should the need arise. And there is a potential problem with RTV: most common types use acetic acid as a curing agent which can do bad things to copper wires and PC boards. I've used automotive RTV that is marked "safe for sensors and electronics" with no problems, however.

What's really needed is a sealant that: 1) has low RF loss and will not alter the electrical properties of the inductor; 2) is easily applied; 3) will not deteriorate over time, and 4) can be easily removed if necessary. It turns out that the perfect stuff is a very common substance and has been used to coat capacitors, inductors and other parts since the early days of radio: Bee's Wax! And it's "all natural" too boot! It can be used to keep windings in place by either dipping the finished toroid in a small container of hot wax or by placing a few "blobs" of wax on the coil and spreading it using a clean soldering iron.

To seal a toroid to a PC board, simply place a blob of wax under the toroid and heat with a clean soldering iron tip. A toroid that has been secured in place with Bee's Wax can be easily pulled loose from the PC board and the wax removed by peeling if from the board and coil, but it will not "lose it's grip" due to moderate amounts of vibration or rough handling. However, it will soften under high temperatures, so it should not be used around heat generating components like power transistors, etc.

So, where does one obtain some Bee's Wax, short of robbing it from a beehive? It can usually be found in hobby stores where candle-making items are sold (make sure to get the pure stuff, not wax mixed with other ingredients or dyes). Unfortunately, you will probably have to buy a "brick" of wax that will last you several lifetimes! Small sticks or blocks can sometimes be found where sewing supplies are sold for use in coating thread. Other sources are no doubt available, but out here in Idaho, options are a bit limited!

—DE W1HUE

PCB PATTERN FOR SWR INDICATOR

From ***William Bowes, N7MOB****, Federal Way, WA, comes this PCB pattern. The quality of the scanned-in drawings may suffer a*

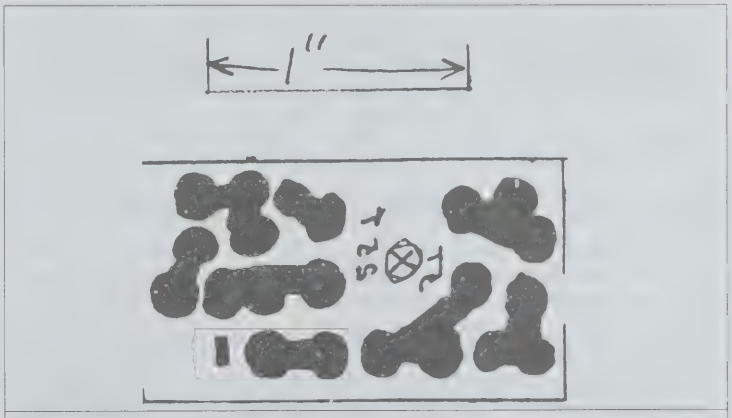


Figure 14. PCB pattern for SWR indicator. (N7MOB drawing)

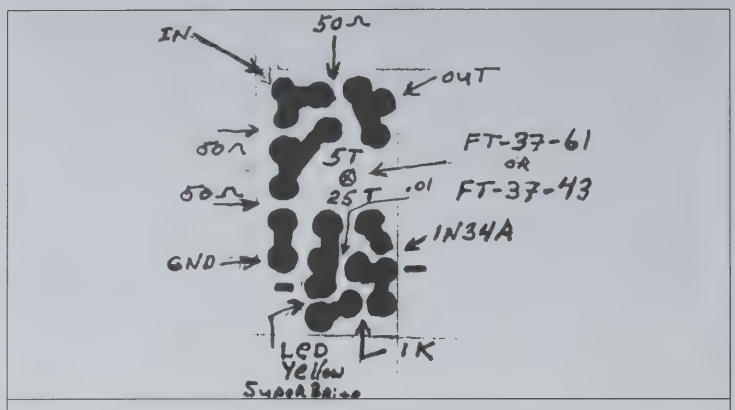


Figure 15. Parts placement. (N7MOB drawing)

bit, but there's enough to work with.

Figures 14 and 15 show my PCB and parts layout of the SWR indicator in the Pete Hoover (W6ZH) ZM-40 tuner (QRP Quarterly, July 1998). [The basic circuit was originated by Dan Tayloe, N7VE and was described in QRPp, journal of the NorCal QRP Club, and slightly modified by W6ZH. Figure 16 shows the schematic as it appeared in the W6ZH article.—WA8MCQ] Copy this page, cut out the template (figure 14), iron onto PCB stock. Soak in water for 24 hours, clean, touch up traces and etch. The components mount vertically.

—DE N7MOB

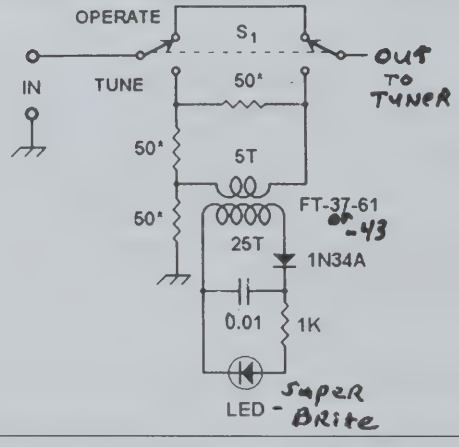


Figure 16. Schematic of SWR circuit (originated by Dan Tayloe, N7VE and slightly modified by W6ZH).

AM MODULATED SIGNAL SOURCE

From ***Frank Brumbaugh, W4LJD*** *of Bradenton, FL (formerly of Salinas, PR)*—Here's an idea which may be ahead or behind it's time. In designing a unique, specialized receiver I had a need for an AM modulated RF signal varied over a span of a few KHz. Since I had used a modulated 955 acorn tube oscillator as a transceiver in the 70 centimeter band in 1950, I developed a modulated crystal oscillator, but not a transceiver this time. (The oscillator is for HF, not the 70 cm band.) The circuit is shown in figure 17. The DC resistance from the emitter of the 2N3904 to ground should be 560 ohms. Select a value of resistor in the ground leg of the 1K transformer winding to come reasonably close to this value. The 0.01 uF capacitor grounds the emitter for RF. The 47 uF cap grounds the bottom of the transformer at audio frequencies. Varying the trimmer cap in series with the crystal varies frequency over a small range.

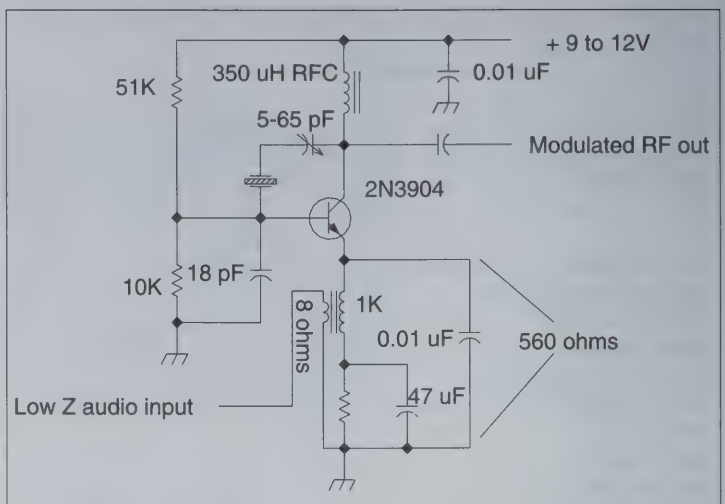


Figure 17. W4LJD modulated signal generator

I don't know if anyone else might have a need for anything like this, but thought I'd pass it along anyhow. I have a hunch that an electret microphone could be used, with the bottom of the 8 ohm winding lifted to +2 or +3 volts to power it, remembering to bypass the bottom of the winding for audio.

—DE W4LJD

QRP ONLINE

QRP-L, which I call the "QRP Daily," is the online QRP discussion forum started in 1993 by Chuck Adams, K7QO. It continues to run several dozen postings per day on a variety of topics related to QRP. QRP-F is an alternative QRP forum started in October 1999 to take some of the load off QRP-L. The forum, QRP-F, requires a web browser such as Internet Explorer or Netscape, while QRP-L is a mail reflector and only requires an e-mail account. To check out either one, just go to the QRP ARCI home page at

www.qrparci.org

You can click on QRP-F and it will take you there directly from your browser. If you click on QRP-L instead, it will link you to

http://www.qrparci.org/qrplacc.htm

or you can go there directly. That page is for information and access for both QRP-L and QRP-F, and you can subscribe to QRP-L from there. It also gives some useful information on the various options available with QRP-L, such as the daily digest mode to bundle a whole day's traffic into a single e-mail, or the POSTPONE mode to put it on "pause" while you're out of town.

While the HTML format of QRP-F may seem a bit odd at first, those who read the QRP-L HTML archives, in the "sort by thread" mode, will feel right at home. About the only real difference between that and QRP-F is that the most recent messages are at the top of the list on QRP-F and at the bottom on the QRP-L HTML archives.

Regardless of the forum, any QRPer who is online owes it to themselves to check out both of these. There is a huge amount of online QRP info flying around, and has been for several years!

The fine print As always, if you have anything you'd like to share with the QRP community, send it along and we'll print it here. Don't worry about the format; even handwritten notes are fine, and I redraw most graphics on the computer. All you have to worry about is getting it to Severn, MD, halfway between Washington DC and Baltimore.

73 and queue our pea DE WA8MCQ

The LDG Z-11 Automatic ATU:
Remote Control & Remote Antenna Switching

by Nils R. Bull Young - W8IJN *email: nilsbull@juno.com*

Abstract

This article describes a remotely tuned antenna system using a commercially available automatic antenna tuner kit and a basic remote control head. Added to this basic system is a base station control head with a remote switching cabinet that connects the tuner to two different antennas. Descriptions of the system include schematic diagrams, pictures of the three basic elements and their interconnections.

Background

In those long-ago days when dinosaurs roamed the pampa and I was in the US Navy, antenna tuners were at the base of the radiating parts of the antenna. Life was easy then. The tuner wasn't forced to find some serendipitous match that included the feed line, the antenna at its end point and all the forces of evil in between.

Recently I moved the radio shack out of the converted outhouse where it has hidden for nearly 15 years and into the small bedroom once occupied by my growing younger son. I began using a home-brew Z-match tuner with about 75 feet of 50-Ohm Ethernet cable and a home-brew 30-ft (<10m) vertical antenna made from aluminum mast and a salvaged CB base antenna. It worked just fine, but as W9BS has noted about my signals, I was usually 30 dB below mental telepathy. Under such circumstances, and with the approach of springtime weather, I decided to make a remote tuner like the GI-Joe stuff that I'd worked with in the Navy.

First Attempts

I began by modifying a stepping switch mechanism to fit the shaft of a 12 position ceramic switch as well as mating a gear-reduction DC motor to the shaft of a Ten Tec 400 pF variable capacitor kit. The project was going well until I put a metal chip in my cornea. This led to a visit to a family practice physician and the same ophthalmologist who had worked on my eldest son's eyes over 20 years ago. We had a nice chat and he removed the "foreign body." While the anesthetic wore off, I made a decision to order the LDG Z-11 automatic tuner.

The Z-11 Automatic Antenna Tuner

The Z-11 is the latest version of the LDG automatic QRP antenna tuner. Like the recently introduced K2 automatic ATU, the Z-11 uses latching relays to manipulate capacitor and inductor elements in an L-network through what I like to call "the tuning dance." Once the Z-11 has tuned the antenna to lowest SWR, the user can turn off the power to the ATU and everything stays as it was at the last tuning cycle. The advertised power limit is 30W. The tuner runs on 12-14 VDC and draws less than 500mA. The Z-11 kit costs $119 without the case. Assembled, tested & boxed, the Z-11 goes for $179.

Building the Z-11 took about eight hours. I wound all the coils first (contrary to the instructions) and assembled the board in short stretches, mainly to avoid suspicious looks from my wife about "the project." I tested the two circuit boards in a multi-purpose aluminum chassis with the appropriate holes and connectors. The Z-11 would tune from 3.5 MHz through 29 MHz easily within the advertised 3 seconds. Once I was satisfied with the operation of the Z-11 both inside the house and out in the shed, I was ready to put the circuit boards in an appropriate enclosure.

Boxing Up the Z-11

I planned to use the Z-11 tuner in two settings. The first would put the Z-11 inside the converted outhouse where it would connect to the base of the vertical antenna mentioned earlier. The second use would be at the base of a portable antenna hanging from a DK9SQ telescoping fiberglass mast. I'd used a simple version of this set-up last summer at a beach vacation. Both scenarios subject the tuner to changes in temperature and humidity. For this reason, I chose a NEMA 4X sealed polycarbonate enclosure (Bud PN-1325) available from Digikey, Mouser or RadioShack.com. This box has a gasket in the lid to protect the innards from wind and rain, but I needed to drill holes in the box to let the RF and DC in and out. This obviously undid the box's weatherproofing, so I used sealing gasket adhesive around the holes inside the box to restore the boxes weatherproofing.

The stock Z-11 has a control panel board with four toggle switches, one push-button switch and four LEDs. The toggle switches are for power, automatic or "semi-automatic" tuning, and for manually running the inductor and capacitor values up or down. The push-button switch starts the tuning dance. Three of the four front panel LEDs show SWR. The fourth LED shows the "status" by lighting during the tuning dance. At first I planned to have just the power and tune switches on the top of the box. Later I decided to use the entire front panel switch array, just for those times when I might decide to put the tuner next to the radio and myself in the RF field (Fig. 1).

Fig. 1: LDG Z-11 tuner box. Power and function switches and LEDs are on the top surface, and input/output connectors are along the edge.

Modifications to the Z-11 ATU

Four wires connect the operating position to the remote tuner. Two lines carry +12 VDC and ground/return. A third and fourth carry the control line and "status" LED lines parallel to those lines on the Z-11 control board. Thus, the "tune" button can be used at the remote operating position while the "status" LED shows the operator that the tuner is doing the tuning dance. This modification involves removing

LED4, and another line to the high side of S5. These lines are routed to the four-pin power/remote control connector on the end side of the enclosure (Fig. 2).

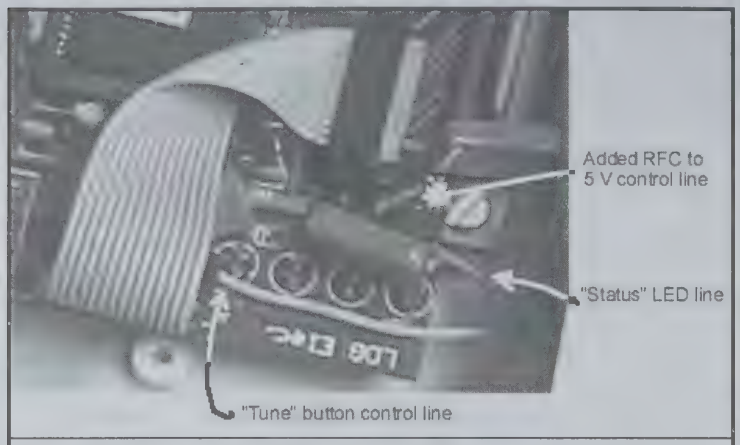


Fig. 2: Added parallel control and status LED lines (yellow & orange, respectively) on the control board. Note the by-pass capacitors and the small RFC on the main board near the control line connectors. These were added to RF proof the control circuit.

I also added a 3PDT switch to route the tuner output between a long wire/coax connection and a 4:1 balun for open wire feed. This switch connects the ATU output to the balun and shifts the ground from one side of the balanced output posts to another common ground post near the input BNC connector (Fig. 3).

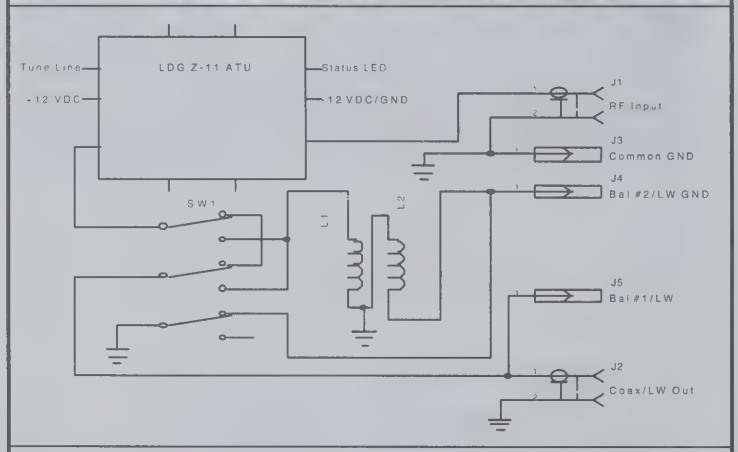


Fig. 3: Output section of box (with schematic) showing balun coil, by-pass caps and RF connections. Note the switch that allows use of the tuner with balanced lines or longwire/coax fed antennas.

Fig. 4: LDG Z-11 Tuner inside the box. Note the added bypass caps at the power plug and on the lines of the main & control boards.

After the board was sealed up in the box, I gave the system a shake-down cruise. With the Z-11 in automatic mode, I could switch bands or band segments and the tuner would retune the antenna with as little as 1 W input. I noticed that the Z-11 would ignore differences in SWR between 10m and 12m or 15m and 17m when connected to the vertical antenna. Of course, I could override the tuner's ignorance by pushing the tune button on the remote control head (described below).

The Remote Control System

Even before the LDG Z-11 tuner arrived, I had already begun work on a remote control head. Two important considerations were involved in the design.

1. I didn't want a thick, stiff cable running from the operating position to the ATU, especially in travel/portable operations. The minimal necessary controls were power, tune and status. Two twisted-pair wires would do that job.

2. The base station set-up was more complicated. I wanted to add antenna switching to the system through a set of accessory switching elements permanently installed in the outhouse. The antenna switching system would be unnecessary in vacation or travel radio, in accordance with consideration #1.

As a result, I constructed one common remote control system for the Z-11 with a separate permanent antenna switching cabinet for the base set up.

There are two antennas in the base system. A vertical antenna works for everything between 7 MHz and 30 MHz using the tuner. The second antenna is 140 ft of wire about 30 ft off the ground. The feedline is a single wire running up the side of the support mast. This antenna works as a long wire on 160m through 10m.

The travel radio antenna consists of a DK9SQ fiberglass mast and 10 meters of small gauge Teflon covered wire is the radiating element with four 10m long counterpoise wires of the same material. Pieces of bent coat hanger wire pushed into the ground tie down the far ends of the counterpoise.

In the basic control head, all controls and connections to the remote tuner are built into the travel radio's charge controller/power interconnection box. A similar circuit is part of the base station power supply box.

The station then runs off any combination of power systems: solar power and battery, wall-wart charger and battery, or commercial power mains with or without battery charge. In any of these settings, I can set the Z-11 to do the tuning dance with the push of a button (Fig. 5a, 5b).

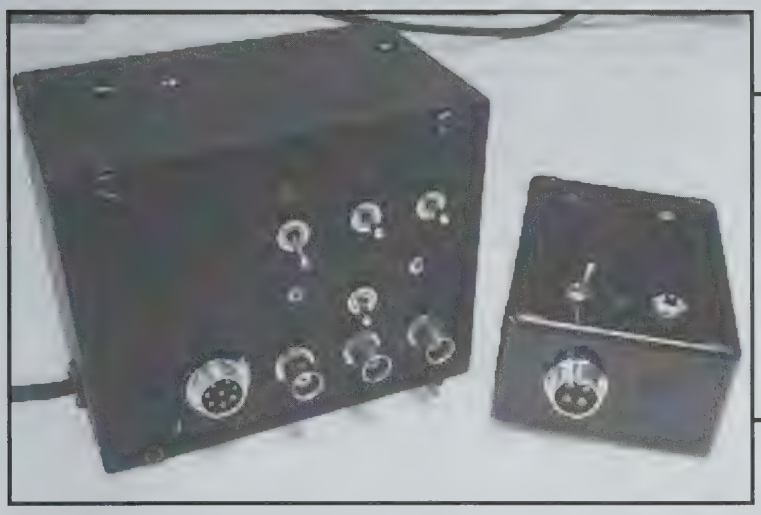


Fig. 5a:
Left: Base station remote control & antenna switching control head (left). Switches across the top are for ATU tune, ATU/thru & Vert/LW switching. BNC connectors switch antenna feed between two rigs or two antenna feeds to one rig. Eight-pin connector on left is feed to remote antenna switching cabinet.

Right: Portable station charge controller & Z-11 remote control (right). Four pin jack feeds Z-11; toggle switch for Z-11 power. LED between toggle & push-button switch is Z-11 status. LED in upper left corner is charge indicator for charge controller.

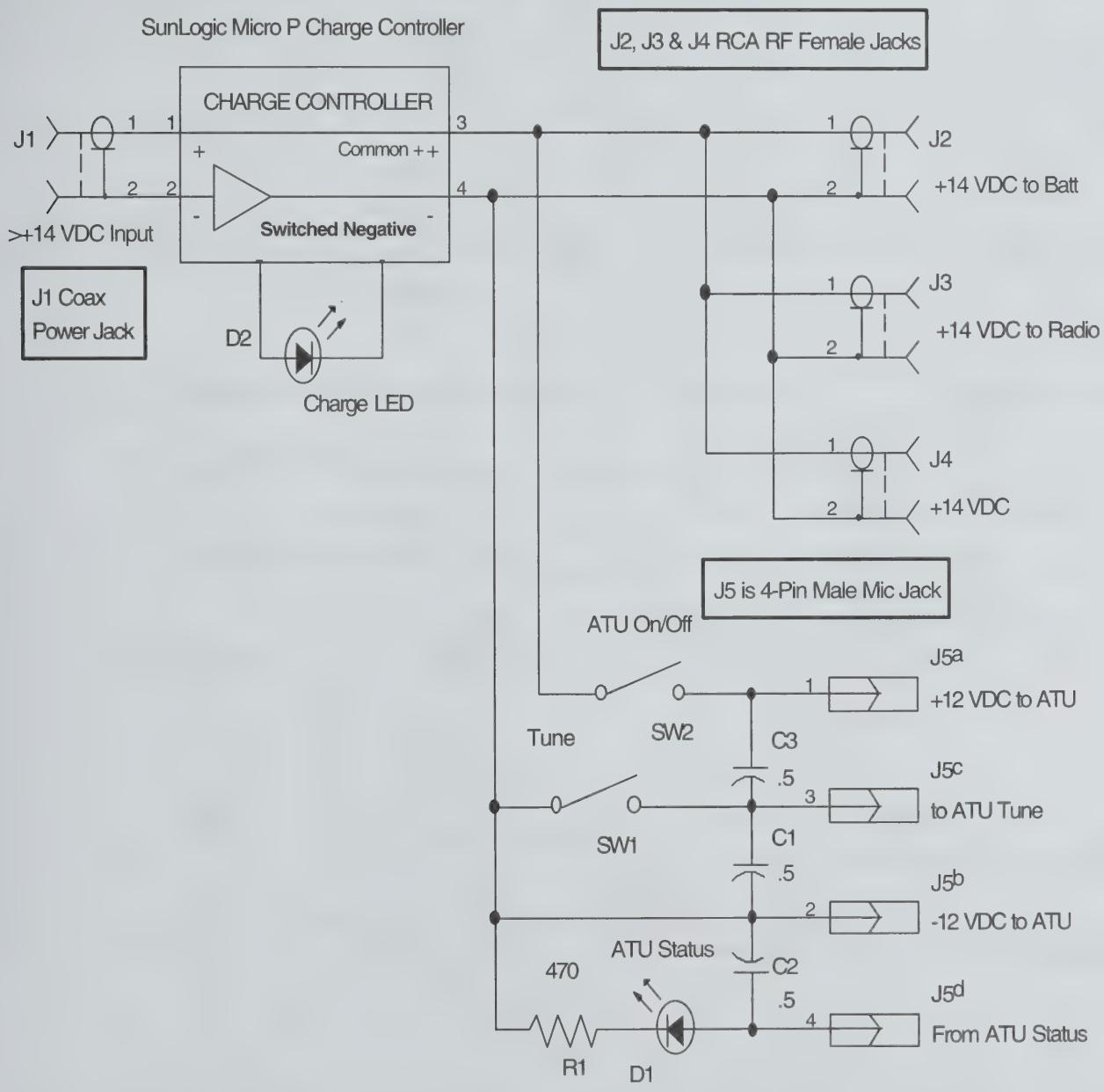


Fig. 5b: Schematic of the basic ATU remote control that includes the charge controller system. A similar circuit, without the charge controller, is built into the base station power supply.

The base station remote control system, with antenna switching as well as control of the tuner, is more complicated. A single DPST switch turns on the power to the unit. This provides 24 VDC for the antenna switching relays and, via a LM7812 voltage regulator, 12 VDC to the tuner. Two DPDT/center off/momentary switches cycle the switching relays and operate the tune line of the Z-11. LEDs provide feedback on the antenna settings and the status line from the tuner. The two antenna setting status LEDs blink when their negative sides are grounded in the switching cabinet.

A single 8-conductor cable connects the base station remote head with the switching cabinet. Another four-wire cable between the switching cabinet and the Z-11 connects the four basic control lines to the four-pin jack on the back of the tuner. (Fig. 6).

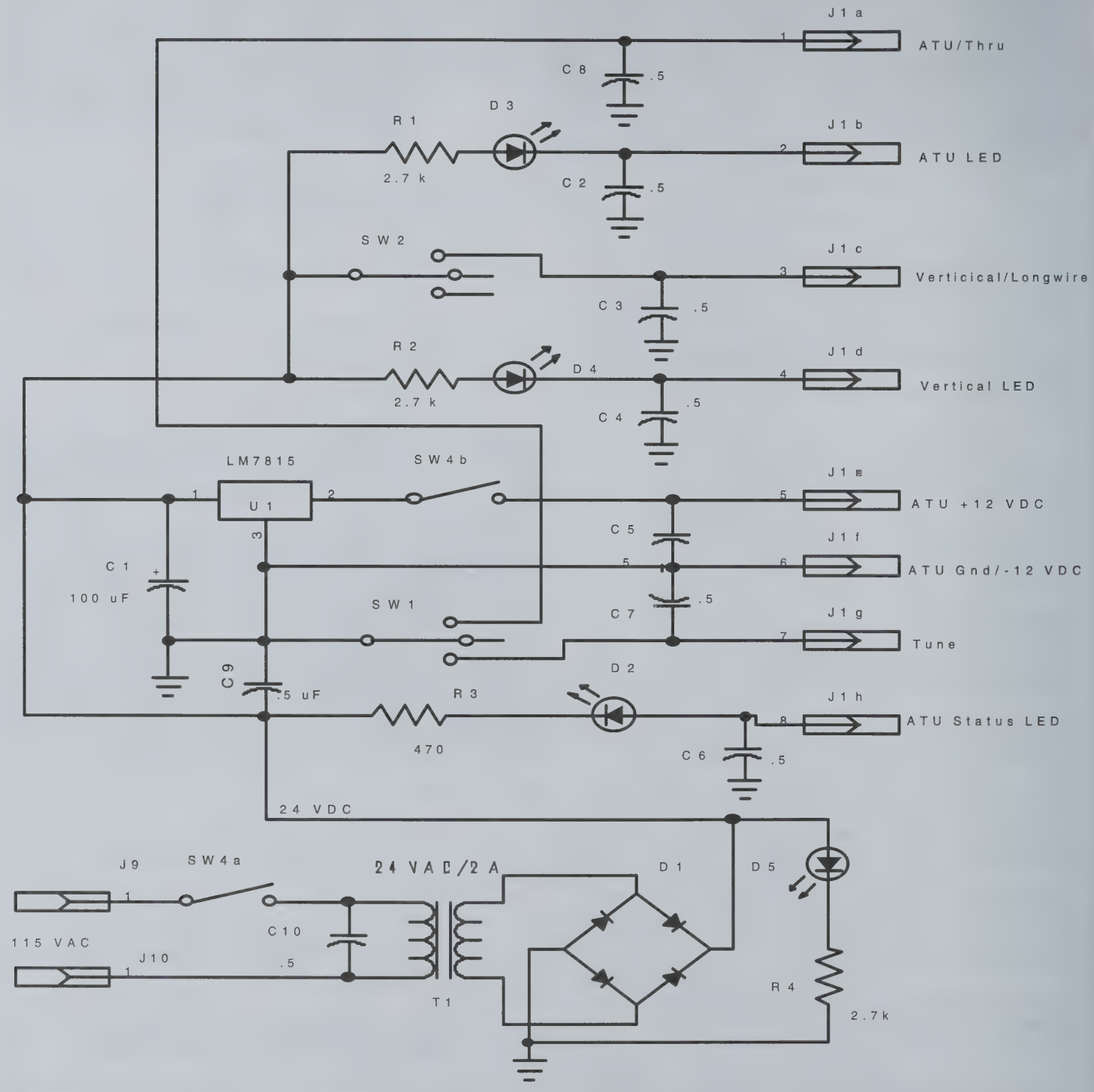


Fig. 6: Schematic of the base station remote control head. The 24 VDC line is for the relays and their feedback LED circuits. The 12 VDC line goes to the Z-11 tuner box.

The switching cabinet holds two 4PDT "ratchet relays." I found these relays at Midwest Surplus Electronics. Two relays provide three settings of the antenna system. With power off and the first relay set to NC condition, the ATU is out of the circuit and its power and output lines are grounded. This is the "thru" condition. When the first relay is stepped, the RF is routed through the ATU and the ATU power is turned on. The second relay routes the RF from the source (tuner or thru) to either of the two antennas, grounding the line from the unused antenna (Fig. 7)

Conclusion and Further Considerations

I've had the Z-11 in remote service now for a couple of weeks. It has worked flawlessly and quickly every time the situation warranted a retune. I figure that I've got the equivalent of a multiband vertical and a portable station vertical antenna system for the cost of one multiband vertical.

It would be easy to modify this design for computer control. Something like the K2's control of that radio's internal automatic ATU would simplify the design and allow the use of latching relays such as are used in the Z-11 or the K2. On the other hand, a stepped rotary switch could easily replace the ratchet relays and add the possibility of even more antennas, such as beams or rotatable dipoles. In many ways this system is just a starting point.

I'm looking forward to trying this antenna system at the beach this summer. Last year, using a piece of wire hanging from the fiberglass mast with the home-brew Z-match and the K2, I worked stations as far away as Australia and as near as North Myrtle Beach. And now that my K2's got SSB, I might just sit beachside and have long-winded gibbering contests with the 3785 gang too. Who knows? I might be able to get a few more dBs above mental telepathy too!

73,, Nils, W8IJN

LDG Electronics' catalog is available at http://www.ldgelectronics.com. LDG Electronics Inc., 1445 Parran Rd., PO Box 48, St. Leonard, MD 20685 USA. Phone: 410-586-2177 Fax: 410-586-8475.

"Ratchet" relays use a standard relay armature and spring-loaded dog acting against a cog wheel to rotate a set of cams on a shaft. The lobes of the cams move the position of the common pole of four 2PDT switches. The relays have a 24 VDC coil and the switched contacts are rated at 300V 3A.

Midwest Surplus Electronics, Inc., 501 W. Main St., P.O. Box 607, Fairborn, OH 45324, USA; 937-879-2250.

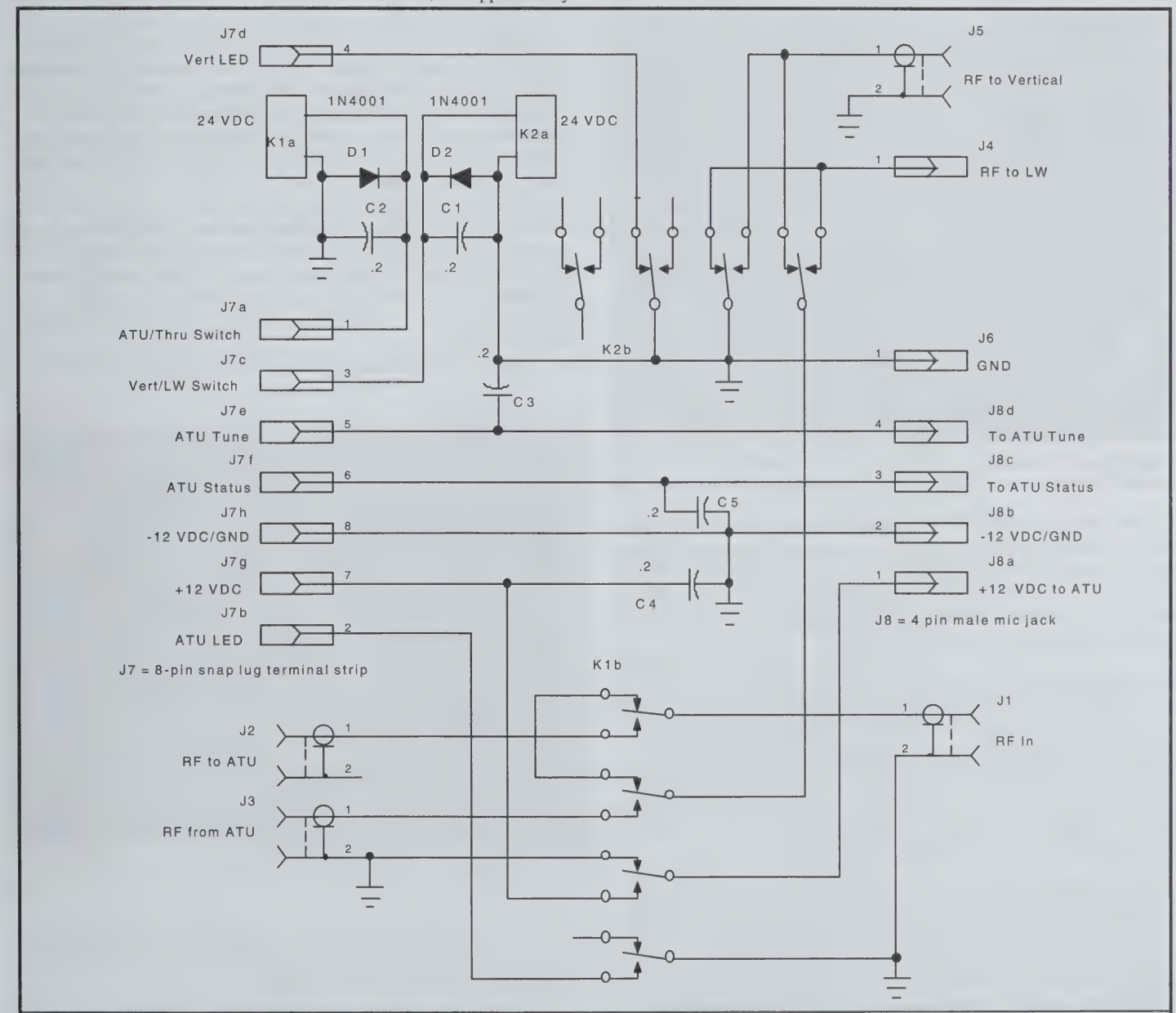


Fig. 7: Schematic of the remote antenna switching cabinet. The two 24 VDC ratchet relays with 200 V/3 A contacts are from a local electronics surplus shop. A similar circuit could be built using appropriate latching relays or a multipole rotary stepping switch.

THE Y2K INDUCTEES INTO THE QRP HALL OF FAME

Mike Czuhajewski WA8MCQ 7945 Citadel Drive, Severn, MD 21144 wa8mcq@erols.com

The QRP ARCI is pleased to announce the latest inductees into the QRP Hall of Fame. Their names were made public at the QRP banquet at Dayton; they are:

- **Michael Bryce, WB8VGE**
- **Joe Everhart, N2CX**

They were honored for their long running contributions to the QRP community. Here's some information on them, greatly condensed from the many nomination letters each received.

Michael Bryce, WB8VGE

Mike Bryce, WB8VGE presented his plaque by Les Shattuck, K4NK

Over the last fourteen years Mike has been on the front lines of the QRP movement, providing insight, guidance and direction for thousands of QRPers through his QRP column in 73 Ham Radio Today magazine. He started it in 1986 and it has proven to be the longest, continuously published column dedicated exclusively to low power communications in the history of ham radio.

Through Mike's efforts, thousands of QRP neophytes have had a mentor in the form of WB8VGE. Unlike most authors who write exclusively for the QRP newsletters, Mike places QRP before the general population of amateur radio on a monthly basis, and has done it for 14 years with no end in sight. Not only do QRPers benefit from his column (and continue to do so), but its mere presence has been silent testimony for years to the amateur community at large that QRP is considered an important and valued aspect of ham radio.

Mike's involvement with the QRP ARCI spans many years. He volunteered to take over the positions of Membership Chairman and Publicity Chairman and spent several years in each, doing yeoman's work in two of the most unglamorous and thankless jobs in the club. The Membership Chairman's position brought with it the unenviable job of being the single point of contact for unhappy members. Mike turned the mundane and frustrating task of dealing with "unhappy campers" into an art form.

In 1990, Mike was the editor of the second edition of the Hotwater Handbook, a compilation of modifications for the Heathkit HW-7, 8 & 9 transceiver kits. This publication had been created by Fred Bonavita, K5QLF (then W5QJM), who later turned it over to the QRP ARCI. When the second edition went out of print and it was apparent that it would probably not be reprinted, Mike single-handedly saved it from almost certain extinction. He seized the initiative and personally took over production of this classic technical text on Heath QRP rigs. Building on the work of K5QLF, he completely reformatted, updated and expanded the Hotwater Handbook and paid to have it reprinted using his own funds. Today, renamed as the HW-8 Handbook, it still serves as the single most valuable technical resource on the classic Heathkit QRP radios.

In addition to his long running QRP column in 73 Amateur Radio Today, he has authored a column for CTM Magazine, feature articles for QST and the QRP Quarterly, plus contributed a chapter in K7YHA's Low Power Communications, Volume II, Advanced QRP Techniques. Several of those QST articles were on solar power. While not a "QRP topic" per se, it is nonetheless of direct interest to QRPers since many use alternate power sources.

Mike Bryce, WB8VGE, is the epitome of a QRPer. He is an outstanding operator and constantly strives to stay on the cutting edge of technology through his articles and columns. Not only does he present low power communications to mainstream ham radio each month, he faithfully served the QRP ARCI for many years in two of the toughest jobs in the club.

Joe Everhart, N2CX

Joe Everhart, N2CX presented his plaque by Dave Benson, NN1G

There are few people in ham radio today who have the combination of in-depth technical expertise, long-time QRP experience, and down-to-earth "common ham" attributes as N2CX.

Joe is a founding member of the New Jersey QRP Club and has assumed the position of technical guru. His NorCal building contest entry

of the "Rainbow Tuner" put New Jersey on the QRP map. He has been pivotal in every kit NJQRP has put out, including the Gusher and Halfer Antennas, the Rainbow Tuner and SWR Bridge (for which he won Project of the Year from QRPp/NorCal in 1997), the Fireball 40 Transmitter, the follow-up FB40 Amplifier and Tick options design, the QRP MicroBeacon, the Rainbow Analyzer co--presented with N2APB at FDIM 1998, the PICpm QRP Power Meter presented at Atlanticon 1999, the SOP Receiver, and the list goes on.

He always brings lots of his projects to meetings and patiently explains them to even the most inexperienced attendees. His enthusiasm for the hobby is obvious and contagious, and it is one of the key factors responsible for the success of the NJ-QRP club. Joe has been a great source of help and knowledge to all in the Club, and they are constantly amazed at his innovative and practical designs. He has constantly come up with novel yet down to earth ways of solving the kit problems.

Joe has played the mentor role for many beginner hams and QRPers over the last decade. He gives very freely of his time and assists in every NJQRP meeting. He is also a regular contributor and technical mentor with N2APB in producing QRP Homebrewer, a new, nationally published QRP journal. Joe's technical accomplishments date back as far as the early 90's with his contributions to the New England QRP newsletter "72", as well as with their fledgling club at the time. N2CX's work has been in print in most QRP publications in the last 10 years, including QRPp and SPRAT. He also makes regular contributions to the Idea Exchange column in the QRP Quarterly in the form of "Joe's Quickies" wherein he describes his own version of handy circuits and tips & techniques in a colorful, intuitive and amazingly simple manner. (The January 2000 issue carried Quickie #32!)

Joe is a valued, regular presenter and contributor at many QRP functions including ATLANTICON, FDIM, PACIFICON and many local (East Coast) gatherings as well. His presentations are enthusiastically attended; he presents with a humor, humility and competence that earns the respect and admiration of all who attend. Joe is always very approachable and generous with his time for those of us who ask for his help with problems, or those who just want to have someone to bounce ideas off of.

He has revealed himself to be a wonderful teacher and mentor, a resourceful technician/engineer, and an absolutely essential ingredient in the success and growth of one of our most dynamic QRP organizations, the New Jersey QRP Club, and the QRP movement in general.

MORE INFO ON THE QRP HALL OF FAME

The QRP HoF is an honor bestowed by the QRP ARCI to recognize those who have made outstanding contributions to the QRP community and/or outstanding accomplishments with QRP.

The call for nomination letters goes out in the fall, the voting on candidates is done in the spring, and the new inductees (if any) are announced publicly at Dayton. Although administered by the QRP ARCI, membership is not required to be nominated or to submit a nomination on a worthy individual. The initial round of inductions was done in 1992; the program was revitalized in 1996 and there have been people inducted every year since.

--qrp--

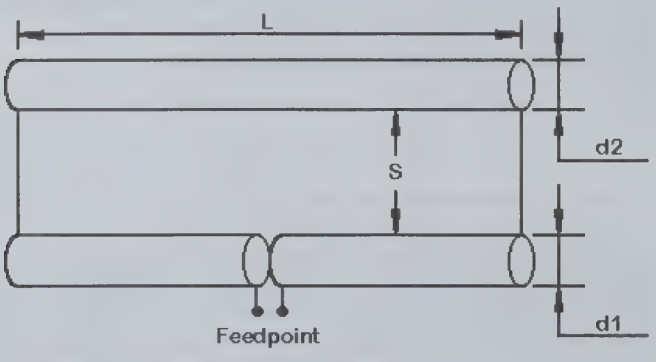
The following, in alphabetical order, have been inducted into the QRP HoF.

Chuck Adams, K7FO 1998
Brice Anderson, W9PNE 1996
Dave Benson, NN1G 1999
Michael Bryce, WB8VGE 2000
Wayne Burdick, N6KR 1998
George Burt, GM3OXX 1996
Jim Cates, WA6GER 1998
L. B. Cebik, W4RNL 1999
Mike Czuhajewski, WA8MCQ 1997
Tom Davis, K8IF 1996
Doug DeMaw, W1FB (silent key) 1992
Rev. George Dobbs, G3RJV 1992
Joe Everhart, N2CX 2000
Paul Harden, NA5N 1999
Wes Hayward, W7ZOI 1996
Doug Hendricks, KI6DS 1997
Roy Lewallen, W7EL 1992
Rich Littlefield, K1BQT 1996
Dick Pascoe, G0BPS 1997
Randy Rand, AA2U 1992
C. F. Rockey, W9SCH 1996
Gus Taylor, G8PG 1998
Adrian Weiss, W0RSP 1996

Unfolding the Story of the Folded Dipole

L. B. Cebik, W4RNL *Knoxville, TN USA* *email: cebik@utk.edu*

The folded dipole is a simple antenna to build. However, it has acquired something of a complex web of correct and incorrect information surrounding it. The point of these notes is to sort out some of the information, with an emphasis upon what it is correct to say about the folded dipole.



The Basic Elements of a Folded Dipole Fig. 1

Fig. 1 shows the essential elements of a folded dipole. It consists of two parallel wires having a constant spacing, S. Each wire has a certain diameter, d1 and d2. The ends of the parallel wires are connected to form a continuous loop. The feedpoint is at the center of the wire having the diameter d1.

Free-Space Azimuth Pattern
Folded Dipole at Fundamental Frequency

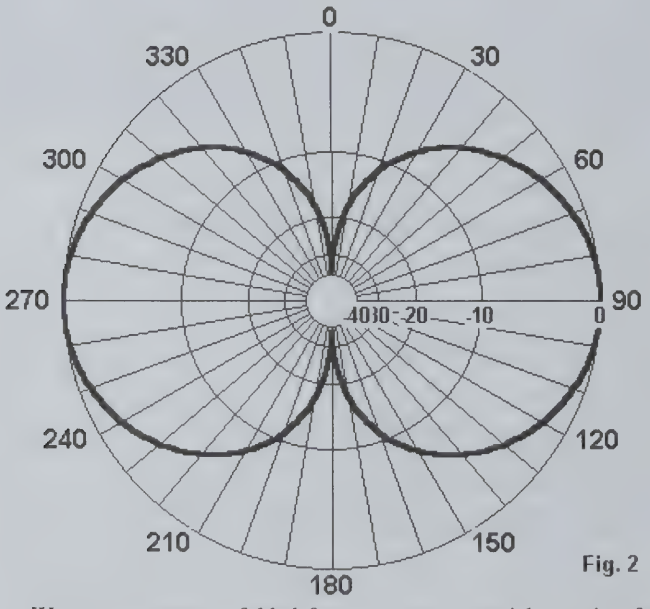


Fig. 2

We can construct a folded from common materials ranging from house wire to parallel transmission line. With such materials, we can obtain the pattern shown as a free-space azimuth pattern in **Fig. 2**--the same pattern as a single-wire dipole. The folded dipole is a reliable antenna, meaning that we can get it to work without lots of finicky adjustments. Something about the ease of building an antenna seems to go hand-in-hand with not get a firm grasp on why it works.

In calling the antenna a folded dipole, we should note that the term "dipole" is important to our discussion. "Dipole" is a term that we use as a shorthand for a longer characterization of a single wire antenna. The 1-wire antenna described is a 1/2 wavelength long, resonant, 2-pole antenna. The reference to length is obvious. Being resonant means that the feedpoint impedance will have negligible reactance and hence be purely or close to purely resistive. Having two poles means having two transitions from maximum to minimum current—in this case starting at the current maximum located at the center of the antenna.

Now all that we need to deal with is the folded aspect of the antenna. Folding refers not only to the visual appearance of the antenna, but as well to what folding does. Folding a single wire antenna (and thereby doubling the amount of wire needed) creates a combination of an antenna element and an impedance transformer. The same principle has been used with other antenna types. For example, the side-fed rectangle—a good vertically polarized performer for the lower HF bands—has a low feedpoint impedance. Doubling the loop with a crossover at the far end from the feedpoint raises the impedance of the antenna.

Using antenna transformer techniques to raise the impedance of an antenna does not reduce any losses inherent in the antenna operation. Loss resistances will also be transformed. These losses are not significant with the standard horizontal folded dipole, but have been a major misunderstanding of its cousin, the folded monopole.

The Folded Dipole as an Impedance Transformer

Our understanding of the folded dipole has been stunted in part by our use of only a special case within the range of possible transformations. By using the same diameter wire for both d1 and d2, we always end up with a 4:1 impedance transformation relative to a single-wire dipole. However, we usually have no idea why this is so. Let's start with the general transformation properties and work our way back to the special case with which we are familiar.

Relative to a single-wire dipole, the feedpoint impedance will be transformed upward by the ratio R according to the following equation:

$$R = \left[1 + \frac{\log \frac{2S}{d_1}}{\log \frac{2S}{d_2}} \right]$$

where the terms S, d1, and d2 have the meanings shown in **Fig. 1**.

The log of 2S divided by a wire diameter is a complex quantity that hides some of the consequences of the equation. However, consider that if d1 and d2 are equal diameters, then the division of one log by the other log results in a value of 1. Since 1 plus this value is 2 and the square of 2 is 4, then for wires of equal diameter, the impedance transformation ratio is always 4:1 relative to the impedance of a single wire resonant half-wavelength dipole.

In free space the impedance, the resonant impedance of a single wire resonant half-wavelength antenna that is center-fed is between 71 and 72 Ohms for highly conductive materials like copper. Hence, a folded dipole using equal wire diameters for both wires will be about 284 to 288 Ohms.

Now let's note some other aspects of the equation. There is no rule against using wires of different diameter for d1 and d2. The wire diameter values always occur as divisors (below the division line). Hence, the larger the diameter, the smaller the resulting log term. Therefore, we get the following guidelines (remembering that d1 is the diameter of the fed wire):

1. If d1<d2, then R is always >4.
2. If d1>d2, then R is always <4.

However, R must always be ≥ 1. That is, 1 is the limit of R as the ratio of the two log values goes to zero, which would imply an immensely large value for d2 or an infinitesimally small value for d1. The result is that a folded dipole cannot be used to reduce the feedpoint impedance relative to a single-wire dipole.

So far, we have ignored S. Before taking a log for the numerator and for the denominator of the fraction in the equation, we must divide twice the wire spacing by the wire diameter(s). This results in a different value in the numerator and denominator for every different wire spacing we choose. Hence, the impedance transformation ratio will also change with every change of spacing.

There is one exception to this consequence of spacing. If the two log values result in a value of 1 when we divide one by the other, then the result will always be 4, regardless of the spacing. Hence, for the case where both wires have the same diameter, the feedpoint impedance transformation relative to a single-wire dipole will be 4:1 for any reasonable wire spacing.

There is a limit to how far apart we can place the wires and still have a folded dipole. That limit, however, is considerably farther apart than the limit for having an effective transmission line with confined fields. It also can be a tiny spacing—just enough to prevent a short circuit between the wires.

Modeling the Folded Dipole

With exceptions that I shall later note, we can use modern antenna modeling software to calculate the properties of folded dipoles of many sorts. For folded dipoles using wires of equal diameter, both MININEC and NEC will yield very accurate results. Remember that the term "modeling" is used in the mathematical sense of calculating antenna properties using equations derived from Poynting Vectors. Hence, the results are very much more accurate than the small rules of thumb formulae we find in many antenna books.

The trick to modeling folded dipoles is to use many segments. The end wires connecting the parallel wires are a limiting factor. In NEC, we want the segment lengths in the parallel wires to be less than a 2:1 ratio in length to the segments in the end wires. In MININEC, we want to use many segments so that the end corners are not mathematically "cut off" in the calculation. So for the models in this exercise, I shall use a frequency of 28.5 MHz with 110 segments along the length of each parallel wire in MININEC to allow a perfectly centered feedpoint. 111 segments are required in NEC. These models will fall well within the calculational constraints of each program type. However, in all cases, the results will apply to bare wire.

As a test case, let's look once more at the question of spacing. We shall use 0.1-in. diameter copper wires throughout for our initial tests. This diameter is between #12 and #10 AWG wire. I shall present both NEC-2 and MININEC results for comparison. (For reference, the NEC-2 results are from NEC-Win Plus and the MININEC results are from AO 6.5.)

Let's compare the performance of folded dipoles having three different spacings. A 1-in. spacing corresponds to the use of ladder line of common commercial sorts. A 4.14-in. spacing corresponds to one recommendation that we use a spacing of 1/100 wavelength. Finally, a spacing of 13.8-in. corresponds to another recommendation that we use a spacing of 1/30 wavelength. In the table below, length refers to the resonant length of the folded dipole, while gain is the free-space gain in dBi. The feedpoint impedance is given in standard series R ± jX Ohms terms.

Note that the two calculating systems yield resonant lengths within about a half-inch of each other. As well, the predicted gain is never more than 0.02 dB apart—a truly insignificant amount. Even the resonant resistance values diverge by less than 1.5 Ohms. The systems are certainly consistent with each other.

Nothing in the spacing of the wires in a folded dipoles could produce a difference that would be discernable to the most accurate field measuring equipment available today. There is no aspect of antenna theory that can justify a claim that one spacing will perform better than another.

Spacing	Length inches	Gain dBi	Feedpoint Z R ± jX Ohms
1 in.			
MININEC	196.56	2.10	288.0 + j0.0
NEC-2	196.93	2.12	286.6 - j0.0
4.14 in.			
MININEC	193.70	2.10	288.0 + j0.0
NEC-2	194.20	2.12	287.0 - j0.1
13.8 in.			
MININEC	186.94	2.12	287.0 + j0.0
NEC-2	187.40	2.13	285.8 + j0.0

Private experience might result in other claims. However, private experience is fraught with many variables of construction and maintenance, as well as antenna location variables. However, equivalently well-constructed folded dipoles of different spacings will perform equally well when placed in identical antenna settings.

Of course, the actual feedpoint impedance encountered by the builder will vary with the height above ground, just as the feedpoint impedance of a single-wire dipole varies with height. The two curves will show a 4:1 ratio in value, but otherwise be congruent.

Before we leave these folded dipoles, let's note the differences in antenna length. Each antenna was brought to resonance by adjusting its overall length. The wider the spacing, the shorter the resonant length. The shortening has two major sources. First, the classic impedance transformation equation does not take into account the end wires. With wide spacing, these wires begin to take up a small part of the antenna length. Second, a 2-wire folded dipole simulates a fat single wire. Just as single-wire dipoles become shorter at resonance with increasing diameter values, so too do folded dipoles with increases in wire spacing.

The handy "468/f" rule of thumb that we use for dipoles is actually only a crude and often inaccurate guide for wire cutting. The resonant length of single-wire and folded dipoles will vary with wire size, spacing (for folded dipoles), and height above ground. If we turn the matter around and cut the antenna according to the old guide, then we can expect different impedance values—including differences in both the resistive and reactive components—as we change wire diameter, spacing, and/or height above ground.

Wire Size

Let's sample what happens with different wire sizes. We shall keep d1 and d2 the same, but change both wire diameters together. For this set of tests, let's use a spacing of 3-in. between wires. Again, we shall look at both NEC-2 and MININEC results. (See table on next page)

All values remain within 0.5% of each other for each set of wire sizes between the two calculating systems. More significantly, there is no perceptible difference in performance predicted for the range of wire sizes.

Although there is a change of resonant length as we change wire size, it is considerably less than the length changes required by differences of wire spacing in the folded dipole. The range of spacing in our tests was 13.8:1, while the range of wire sizes was 12.4:1, comparable ranges. However, the length range was only about 1.5-in. for the wire size differences, but 4.5-in. for the spacing differences.

With respect to length and performance, a folded dipole acts very much like a single fat wire. In fact, a single wire dipole will have a length of about 199.8-in. using 0.1-in. diameter copper wire to be resonant and have a free space gain of about 2.10 dBi. All of our folded dipoles are shorter, since all are effectively much larger in diameter. To have a resonant length equal to that of the #18 AWG wire folded dipole above (about 195.8-in.), a single copper wire would need to be just

about 1-in. in diameter. (Reminder: all tests are at 28.5 MHz for consistency throughout this exercise.)

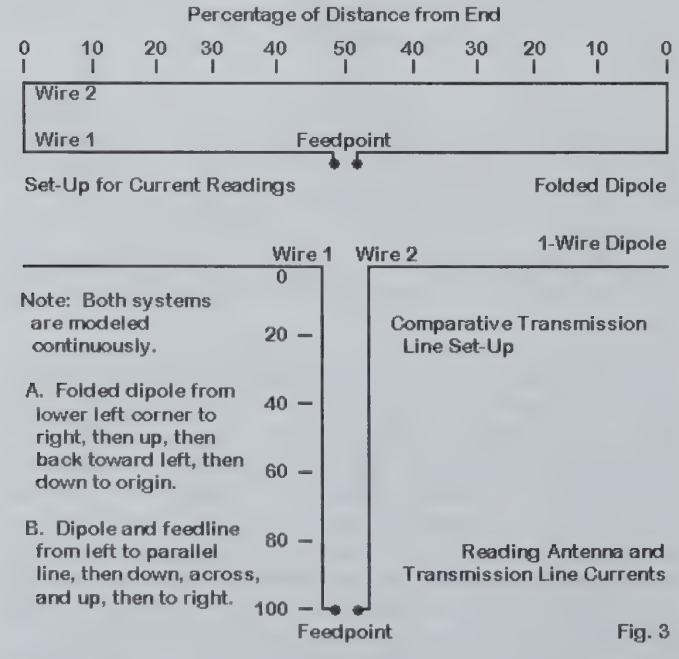
Wire Size	Length inches	Gain dBi	Feedpoint Z R ± jX Ohms
0.5 in.			
MININEC	192.10	2.10	287.0 + j0.0
NEC-2	193.04	2.13	285.3 - j0.1
#10 AWG			
MININEC	194.54	2.10	288.0 + j0.0
NEC-2	195.09	2.12	286.9 - j0.0
#12 AWG			
MININEC	194.90	2.10	288.0 - j0.0
NEC-2	195.31	2.12	287.2 - j0.0
#14 AWG			
MININEC	195.16	2.10	289.0 + j0.0
NEC-2	195.51	2.12	287.6 + j0.0
#18 AWG			
MININEC	195.63	2.09	290.0 + j0.0
NEC-2	195.88	2.10	288.5 + j0.0

Antenna Currents and What They Tell Us

One very unhelpful conception of a folded dipole is to think of it as some kind of transmission line. We often abet this conception by drawing pictures of the antenna with arrows showing the direction of current at some give instant in the history of a signal transmission. Hence, we perpetuate the notion of an antenna being like a wire in a circuit.

For static charges that might build up on an open-ended dipole, the folded dipole has the advantage of providing a path across the feed line for their discharge. However, for understanding the operation of the antenna, we should discard such pictures. We have already seen that folded dipoles will perform normally with wire spacings considerably larger than is optimal for a transmission line (13.8-in. at 10 meters).

A folded dipole operates in ways distinctly unlike a transmission line. For example, in a properly functioning transmission line, at any point along the line, the current magnitudes will be equal, but the current phases will be opposite, that is, 180 degrees apart. If a resonant folded dipole acted as a transmission line, we should expect to see the same pattern of current values between the two wires.


Percentage of Distance from End
0 10 20 30 40 50 40 30 20 10 0
Wire 2
Wire 1
Feedpoint
Set-Up for Current Readings
Folded Dipole
1-Wire Dipole
Wire 1
Wire 2
0
20
40
60
80
100
Note: Both systems are modeled continuously.
A. Folded dipole from lower left corner to right, then up, then back toward left, then down to origin.
B. Dipole and feedline from left to parallel line, then down, across, and up, then to right.
Comparative Transmission Line Set-Up
Reading Antenna and Transmission Line Currents
Feedpoint
Fig. 3

To demonstrate this, we can use the model on the lower half of Fig 3 to derive the currents along the transmission line. A sample every 20% of the way of a line nearly, but not quite, one wavelength long is instructive. We shall present two sets of current phase figures for wire #2: one set derived from the modeling convention of continuously developing the model from left to right, the other from using the dipole junction as the starting point for both wires.

Currents

	Wire 1		Wire 2	
Distance	Magnitude	Phase	Magnitude	Phase
0%	1.001	0.1	1.001	- 0.0 / 180.0
20%	0.419	18.1	0.419	18.1 / -162.0
40%	0.758	173.5	0.758	173.5 / - 6.5
60%	0.861	-174.6	0.861	- 174.6 / 5.4
80%	0.270	- 31.1	0.270	- 31.0 / 48.8
100%	0.999	- 0.2	0.999	- 0.2 / 179.8

The modeling convention that runs the transmission line wires in opposite directions shows essentially the same values for each point on the line. The convention that starts and ends them in the same direction shows the 180-degree out-of-phase condition.

To illustrate what we actually encounter with a folded dipole, let us turn to the upper portion of Fig. 3. The markers represent percentages of distance from the outer end of each wire inward toward the center. If we plot the current magnitudes and phases for a typical folded dipole, we end up with an interesting chart. Let's use our #18 bare copper wire folded dipole with 3-in. spacing as a test case. Current magnitudes are relative to a maximum value of 1.0, while current phases are relative to a feedpoint value of 0.0 degrees. The first current phase figure for Wire 2 is for continuous modeling so the end 2 of one wire becomes end 1 of the next. The second value presumes a model with both parallel wires starting at the same end of the assembly.

Currents

	Wire 1		Wire 2	
Distance	Magnitude	Phase	Magnitude	Phase
0%	0.256	- 74.5	0.244	-106.4 / 73.6
10%	0.463	- 33.8	0.432	-153.0 / 27.0
20%	0.682	- 20.2	0.659	-166.5 / 13.5
30%	0.855	- 12.4	0.842	-172.6 / 7.4
40%	0.964	- 6.2	0.960	-176.1 / 3.9
50%	1.000	0.0	1.000	-177.9 / 2.1

The chart ends at the antenna center point because the opposite side of the antenna shows virtually identical current values at the prescribed points. Although the current magnitudes are comparable (and would be closer had the wire been without any loss at all), the current phase values show a curious pattern. Corresponding point along the wires show similar absolute current phase values, but they are opposite in sign when both wires are modeled from the same point (e.g., left to right). The pattern is distinctly unlike a transmission line that is acting like a transmission line, even with the far end a short circuit.

A phase pattern similar to the one shown is necessary if the folded dipole is to radiate. Radiation is simply the ability of the fields that result from the current levels at each point along the antenna to expand without limit. This condition is unlike that in a transmission line, where the fields are confined such that radiation is negligible. For that condition to exist, the current magnitudes would have to be equal, and the phase values must be exactly opposite.

The upshot is that we need not treat a resonant folded dipole made of transmission line like a transmission line. We can ignore the velocity factor for the line as a line and only adjust the length according to the antenna velocity factor created by the line insulation (perhaps a percent or two shorter). The practice of shorting out a folded dipole at the point indicated by the transmission line velocity factor has never shown any evidence of doing anything but shorting out the wires at that point. Finding the resonant length of the folded dipole will be challenge enough.

Calculated				Modeled		
Diameter d1	Diameter d2	Z Ratio	Feed Z R=Z Ohms	Length inches	Gain dBi	Feed Impedance R ± jX Ohms
0.1	0.5	7.01	498	193.34	2.09	493.0 + j0.0
0.2	0.4	5.09	361	193.20	2.10	363.0 + j0.0
0.3	0.3	4.00	284	193.10	2.10	288.0 - j0.0
0.4	0.2	3.23	229	193.48	2.11	234.0 - j0.0
0.5	0.1	2.58	183	193.96	2.11	189.0 - j0.0

Other Impedance Values

The folded dipole is ultimately simply a dipole with an impedance transformation mechanism built into its structure. As a dipole, on its fundamental frequency, it provides all of the performance we expect from a dipole—no more and no less. It tends to have a slightly wider SWR operating bandwidth (when transformed to our feedline value) than a single wire dipole because it acts like a fat wire. But it remains in performance simply a dipole.

The impedance transformation possibilities, however, should not be overlooked. The rules of thumb for transformation more than or less than 4:1 can be useful in some contexts. Before looking at potential applications, let's first look briefly at the levels of departure from 4:1 as we systematically vary the element diameters. We shall use the 3-in. spacing from earlier samples, but this time, we shall run each wire through a range of 0.1 to 0.5 inches in diameter—with one wire increasing as the other decreases.

To perform the modeling for this task, we shall set aside NEC-2. NEC has a known difficulty in dealing with closely spaced wires of different diameters. Fortunately, MININEC has no such limitation and handles the calculation task with ease. We shall list the impedance ratio calculated by the equation on the first page, the resultant feedpoint impedance, and then the modeled values. This should give us a quick view as to whether the calculations and models reliably coincide. The results are shown in the table at the top of this page. Given that the calculations do not account for the end wires, the coincidence of models and calculations is excellent. Incidentally, in all models, the end wires were sized to match the smaller of the two diameters involved. Moreover, the absence of any perceptible change of gain in the series of models is notable. However we size the wires in our folded dipole, it gives us dipole performance. To at least some degree, this convention accounts for the very small differences in resonant lengths of the models.

In many beams using the dipole as a driven element, the feedpoint impedance will be far less than 70-72 Ohms. Values from 10 to 50 Ohms are common, although values above 20-25 Ohms are preferred in order to reduce power losses from the accumulation of small resistances at connections. Using a folded dipole with "designer" values for element diameters and spacing, it is possible to raise the impedance to match almost any value higher than the initial feedpoint impedance. One option is to use a low transformation ratio to arrive directly at 50 Ohms. A second option is to use a higher value to arrive at 200 Ohms and then to use a 4:1 balun at the feedpoint to return to 50 Ohms with an accompanying reduction of possible common mode currents on the coax. Although HF use of folded dipole drivers is rare, at VHF they are still very popular.

The Folded Dipole as a Doublet

Before departing the land of folded dipoles, we should at least glance at the potential of the folded dipole as a multi-band doublet. As a sample, we can look at the performance potential of an 80-meter folded dipole. I resonated a 132.85-ft. version at 3.5 MHz. Wire spacing is about 2-in. and the wires are about 0.3-in. in diameter. I then checked the patterns and performance on other amateur bands. Numbers are rounded, since we are looking only for suggestive results.

Frequency MHz	Max. Gain dBi	Feed Impedance R ± jX Ohms	Pattern No. of lobes
3.5	2.12	287 - j 1	2
7.0	2.27	5 - j 160	2
10.1	3.31	540 - j 750	6
14.0	3.34	25 - j 330	4
18.1	4.71	480 + j 15	10
21.0	4.26	85 - j 530	6
24.9	4.75	550 - j 310	14
28.0	5.03	225 - j 750	8

The gain figures and the number of pattern lobes coincide with numbers we would obtain from a single-wire dipole pressed into multi-band doublet service. What differs is the impedance value set. The difficulty of using a folded dipole on an even harmonic of the band for which it is initially resonated lies in the very low resistive component of the feedpoint impedance. By the sixth harmonic, we have a value that, while low, is well within the capabilities of most ATUs. In contrast, the second harmonic impedance of 5 Ohms is likely beyond the reach—or at least the efficient range—of most ATUs. The fourth harmonic (20 meters in this sample) might well be matchable, depending upon ATU design.

Fig. 4 shows the free-space azimuth pattern for 14 MHz, with its typical 2-wavelength 4-lobe pattern. **Fig. 5** presents the 6-lobe, 3-wavelength pattern for 21 MHz. The point of these figures shows up in **Fig. 6**, the pattern for 18.1 MHz. At about 2.5 wavelengths long, the antenna shows both the growing lobes for the 3 wavelength pattern and the diminishing lobes for the 2 wavelength pattern—for a total of 10 lobes.

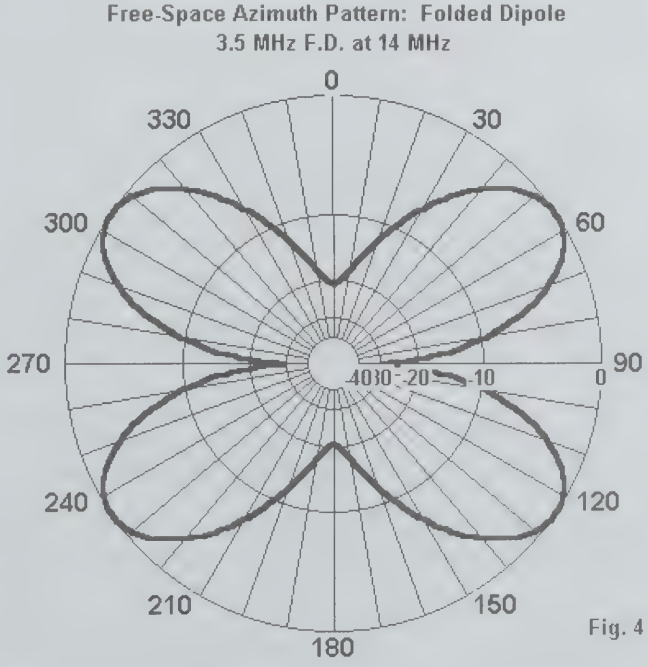


Fig. 4

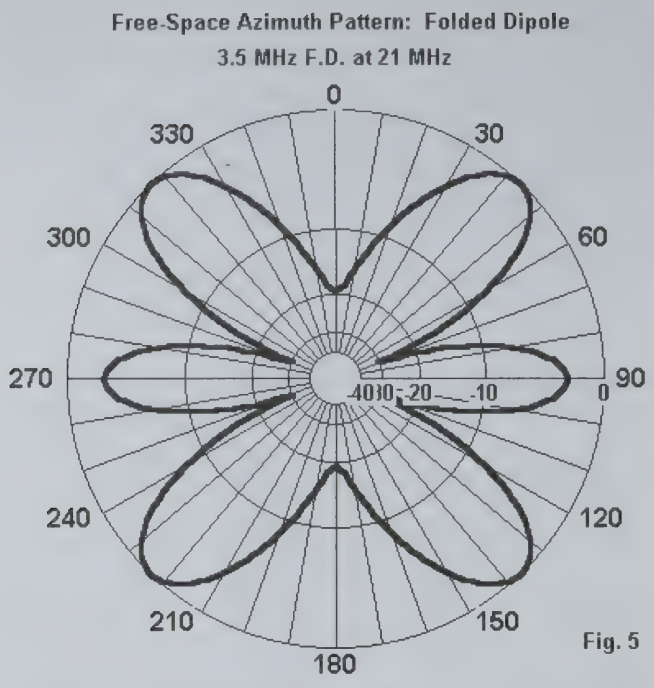


Fig. 5

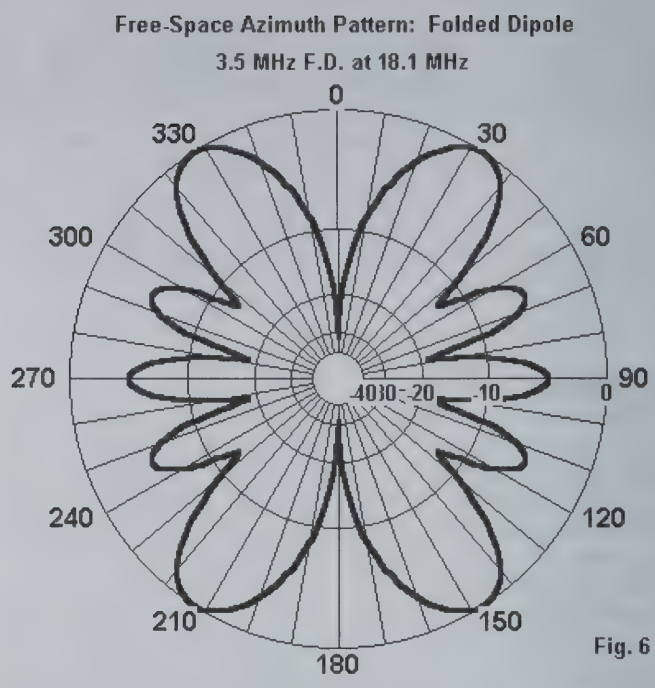


Fig. 6

Using a folded dipole as a multi-band doublet—with parallel feedline to an antenna tuner—thus becomes a matter of matching rather than of pattern development. Very low impedances may also be lossy, thus reducing performance even if a match can be obtained from a given ATU and feedline length.

For multi-band use, a folded dipole offers no advantage over a single-wire doublet of the same approximate length. Indeed, in the final analysis, perhaps the only reason for using a folded dipole is when the impedance transformation is of special interest, that is, when it may resolve an antenna design challenge. A secondary use would be to offer a path to discharge static charge build-up and thus to reduce one (of the many) noise sources. However, there are other means to this same goal.

Otherwise, the folded dipole performs just like a fat single-wire dipole.

[Be sure to visit LB's web site – http://www.cebik.com/ – for a wealth of information on antennas and antenna modeling. –W1HUE]

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QRP-L Foxhunt Team Tesla's Terrors
. . . accepting plaques at Dayton FDIM Banquet

Two plaques were presented this year. One for the top scoring "hound" team sponsored by QRP-Canada, and the second plaque was for Clean Sweep by a "hound" team sponsored by the Knightlight QRP Club Both were stunning plaques hand carved by Ken LaRose, VE3ELA.

Both plaques were won by Tesla's Terrors. The team consisted of Dan Copeland, N0DT; Wayne Alexander, N0EA; Tim Smith, N0EHW and Joe Smith, W0JOE. I'm not sure how they accomplished the Clean Sweep. What a great team of ops.

Dan Howard, VA3MA presenting the Foxhunt Top Scoring Team plaque to Dan Copeland, N0DT. It's difficult to see in the photos but the Tesla's Terrors had the most striking embroidered shirts.

The Knightlites presenting the "Clean Sweep" plaque. From left to right are: Bob Kellog, AE4IC; Wayne Alexander, N0EA, (of Tesla's Terrors) Randy Hargenroder, WJ4P and Les Shattuck, K4NK.

The HAMOEBA

A 100mW Single-Cell CW Tranceiver

by Duncan Walters, G4DFV 11 King George V Ave., Mansfield, Notts Ng18 4ER, U.K.

This project was inspired by the "1-Volt Challenge" laid down by Ken Evans, W4DU, as mentioned in SPRAT 101, to produce a working CW transceiver powered by just a single 1.5 volt cell power source, and built using no i.c.'s, only discrete components.

The 10 MHz band was selected on which to base the design of the transceiver, as previously successful two-way intercontinental CW communications from the G4DFV shack had been achieved on these frequencies using a power output of just 2 watts. There is no reason, of course why the Hamoeba could not be used on other bands by changing the tuned circuits and input and output filters.

It soon became apparent, when building began, that obtaining 100mW from a transmitter powered from just 1.5 volts was going to be more difficult than at first visualized. Perhaps the most startling (and annoying!) surprise came when substituting the two VN10KM output devices for others with differing batch numbers. It was found that only devices bearing the same batch number as the original ones used in the design would give 100mW output into a 50 ohm load.

Other devices gave 50mW or less. Why this should be is presently unknown, perhaps it may be that 10 MHz is approaching the upper useful frequency limit of these devices, and that only full-spec ones will deliver sufficient output.

The batch number that was printed below VN10KM on the mosfets was "T930".

There is perhaps plenty of scope for experiment here where alternative types of device could be tried in the output stage. I would be pleased to hear from anyone who achieves success on these lines.

TRANSMITTER

The heart of the transceiver is the VXO, based around Q1 and a 10.158 MHz crystal. The inductance of T1 in combination with variable capacitor VC1 is used to pull the frequency of the crystal. The frequency range with the tuned circuit components plus "strays" is 10.147 to 10.127 MHz.

A crystal of around 10.130 MHz could be used to give coverage of the lower part of the band. Closing S2 brings in VC2 across the second winding. Adjustment of VC2 provides RIT. S2 has to be open during transmit.

Output from the VXO is coupled via C3 to Q2, which drives the gates of Q3 and Q4 via transformer T2. VXO output is also taken via C14 to buffer Q5, which supplies local oscillator injection to the receiver balanced mixer.

Output from the two push-pull VN10KM devices is coupled via tuned transformer T3 into a low-pass filter comprising L1, L2, C8, C9 and C10.

RECEIVER

Direct conversion was chosen for simplicity and produces an effective working receiver with the minimum of complications. The antenna signal is fed via S1c to a 10.100-10.150 MHz band-pass filter, comprising transformers T4, T5, C25, C26 and C27. Output from this filter is taken to a coupling winding on T6, a trifilar wound transformer, which, together with Schottky hot-carrier diodes D1 and D2, form a balanced mixer.

TC1 is used to peak up at 10.137 MHz, center of the frequency coverage. RV1 is adjusted for minimum AM broadcast breakthrough.

AUDIO STAGES

Audio signals from the balanced mixer are fed via C30 to the base of preamplifier Q7. Output from the collector passes to the AF gain control RV2 via C18. Audio filtering, provided by T7, T8, C19, C20 and C21, is switched in or out as desired by S3. Q8 and Q9 form a high gain darlington pair which drive a pair of ex-army medium impedance balanced-armature headphones, type DLR No.5. Other headphones were tested in this circuit with varying results, but the ex-army prevent harsh clicking sounds reaching the headphones.

POWER SUPPLY

The transceiver was initially tested and set up using a variable voltage bench power supply set at 1.50 volts, but is designed to run satisfactorily on a single Duracell "D" cell. Other non-rechargeable batteries will work, but due to the heavy current drain, their voltage soon drops below useful level.

Ni-cad batteries have not been used as they only supply 1.25v. A difference of quarter of a volt makes quite a significant change at this power level.

RESISTORS

R1 150R
R2 8K2
R3 68K
R4 6K8
R5,R6,R11 1M
R7 8K2
R8 150K
R10 1K
R12 27K
R13 100K
R14 4K7
RV1 1K lin preset
RV2 10K log with switch

SEMICONDUCTORS

Q1,Q6,Q7,Q8,Q9,Q10 BC109C
Q2 2N2222
Q3,Q4 VN10KM (see text)
D1,D2 BAT41 Schottky Diodes

CAPACITORS

C1 470pF
C2 150pF
C3, C15 1nF
C4, C5, C11, C12 100nF
C6, C16, C23, C29 10nF
C7 780pF (2x390pF)
C8, C9 540pF (2x270pF)
C10 270pF
C13 100uF 16v
C14 330pF
C16 10uF 16v
C17, C22, C24 47nF
C18 1.5Uf 16v
C19, C21 100nF
C20 220nF
C25, C27 47pF
C26 6p8
C28 68pF
C30 1uF 16v
C31 470uF 16v
C32 560pF
C33 47pF
TC1 50pF min. trimmer
TC2 50pF min. trimmer
VC1 166pF + 50pF polyvaricon
VC2 166pF + 50pF polyvaricon

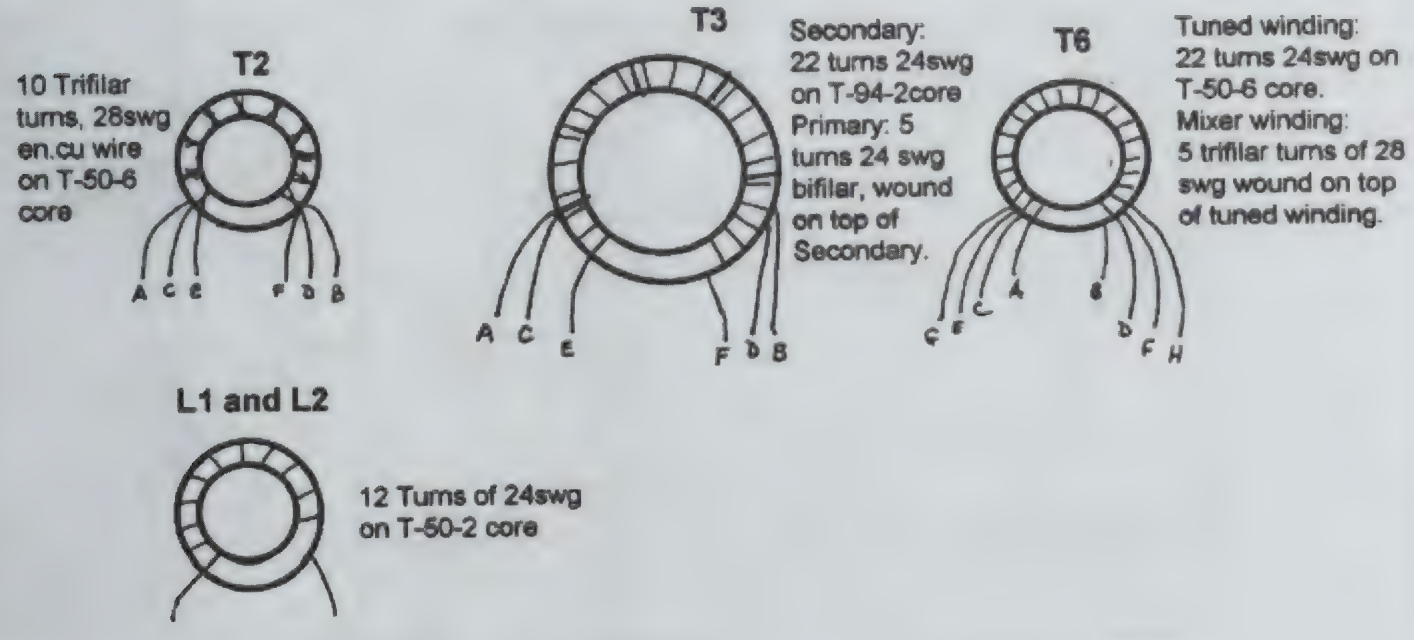
INDUCTORS

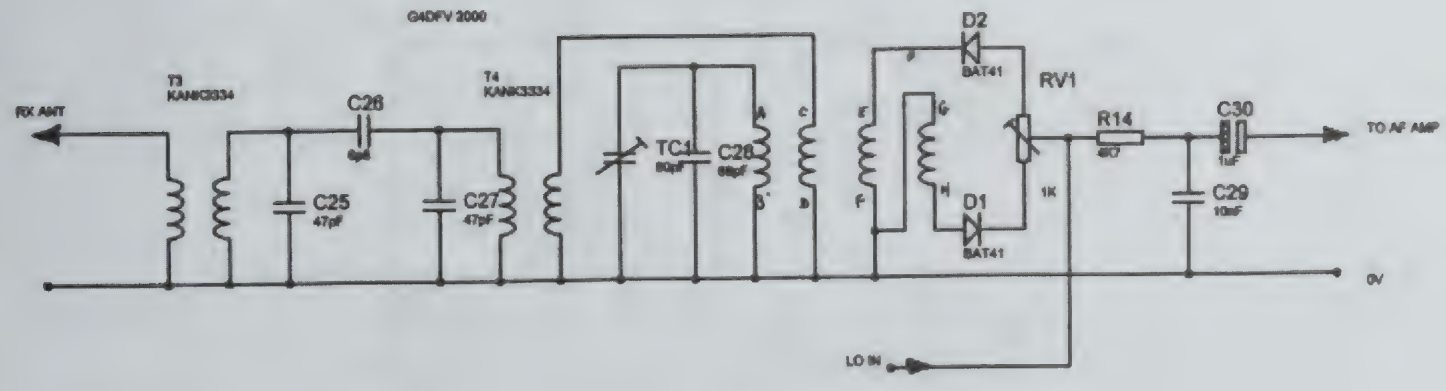
L1,L2 wound on T-50-2 cores
T1 Toko KANK3333R
T2 wound on T-50-6 core
T3 wound on T-94-2 core
T4,T5 Toko KANK3334
T6 wound on T-50-6 core
T7,T8 Eagle LT44 audio driver transformer
T9 Eagle LT700 audio output transformer
RFC1, RFC2 47uH min. axil choke

SWITCHES

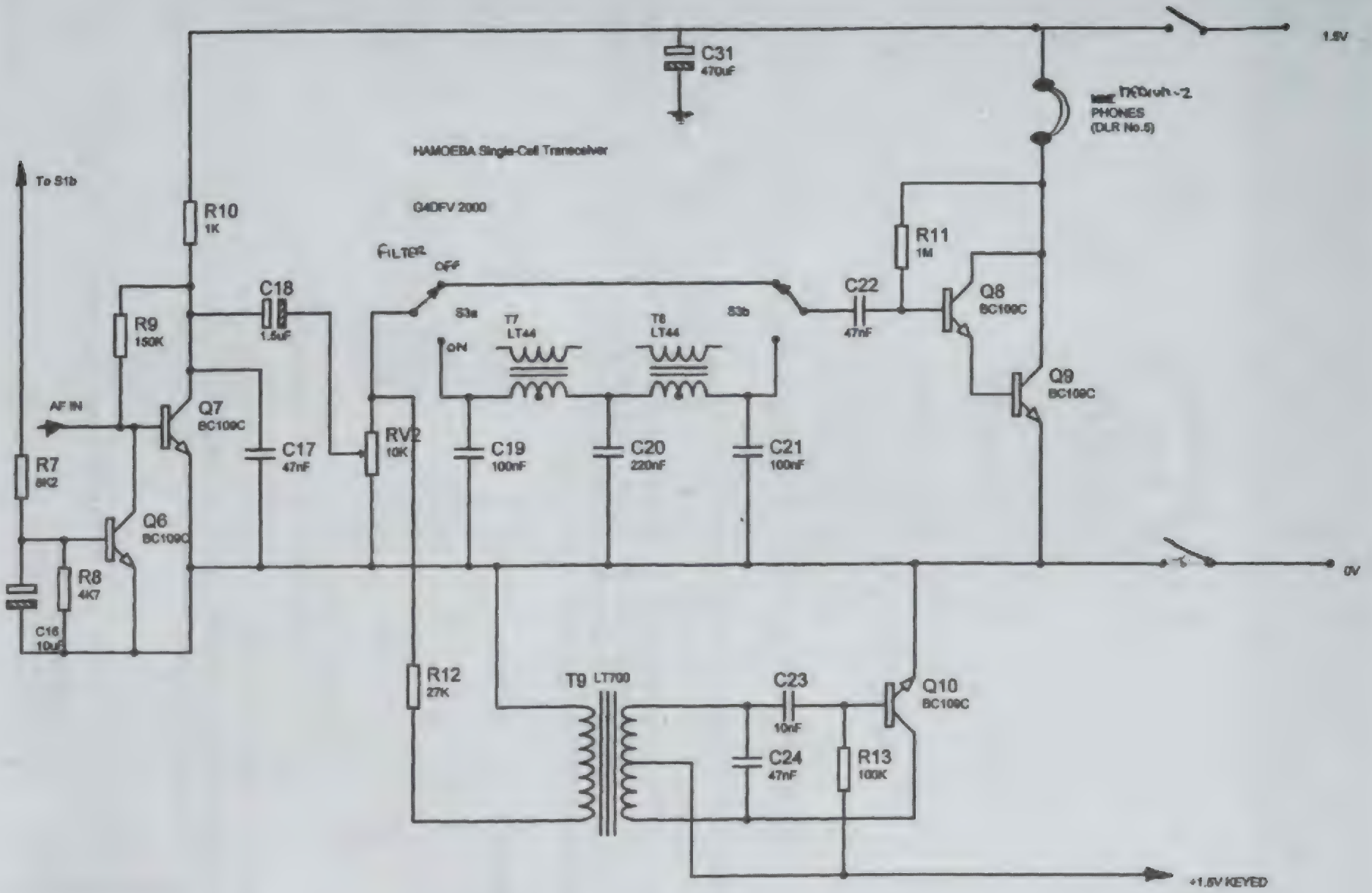
S1 3 pole rotary
S2 Single pole c/o min. toggle
S3 2 pole c/o min. toggle

WINDING DETAILS OF T2, T3, T6, L1 AND L2


T2
10 Trifilar turns, 28swg en.cu wire on T-50-6 core
A C E F D B
T3
Secondary: 22 turns 24swg on T-94-2core
Primary: 5 turns 24 swg bifilar, wound on top of Secondary.
A C E F D B
T6
Tuned winding: 22 turns 24swg on T-50-6 core.
Mixer winding: 5 trifilar turns of 28 swg wound on top of tuned winding.
G E C A B D F H
L1 and L2
12 Turns of 24swg on T-50-2 core



HAMDEBA Single-Cell Transceiver
G4DFV 2000
+12V
0V
TO SIDETONE
KEY
TO MUTING CIRCUIT
TO RX MIXER
S1A
S1B
Ant Sock
Ex Ant
L1
L2
T1
T2
T3
C1
C2
C3
C4
C5
C8
C9
C10
C11
C12
C13
C14
C15
C16
C32
R1
R2
R3
R4
R5
R8
RFC1
RFC2
Q1
Q2
Q3
Q4
Q5
X1
VC1A
VC2A
VC2B
VFO TUNE
RIT


HAMOEBA Single-Cell Transceiver
G4DFV 2000
To S1b
1.5V
0V
C31
470uF
R10
1K
R11
1M
R9
150K
C18
1.5uF
FILTER
OFF
ON
S3a
S3b
C22
47nF
Q8
BC109C
Q9
BC109C
T7
LT44
T8
LT44
AF IN
Q7
BC109C
C17
47nF
RV2
10K
C19
100nF
C20
220nF
C21
100nF
R7
8K2
Q6
BC109C
R8
4K7
C16
10uF
R12
27K
T9 LT700
C23
10nF
Q10
BC109C
C24
47nF
R13
100K
+1.5V KEYED

The 1 Volt QRP Transceiver

Design by Helmut Seifert, DL2AVH and PCB Layout by Gero Schusser DL4ALJ

Our Goals:

Save the resources of our earth, save the earth
Reduce battery waste
Reduce required materials
As much fun as possible, so make a **real** useful **transceiver**

Modern solid state technologie makes it possible to design RF transmitters and receivers with a powers supply as low as 1 Volt with good efficiency. The mainly power consumpting parts, the AF end-amplifier and the RF-PA have to be designed very carefully to give good results and to meet the goals. The efficiency today would be optimal at 3 Volt. This experimental design will be the base for a 3 Volt Transceiver with an RF power of > 0.5 Watt.

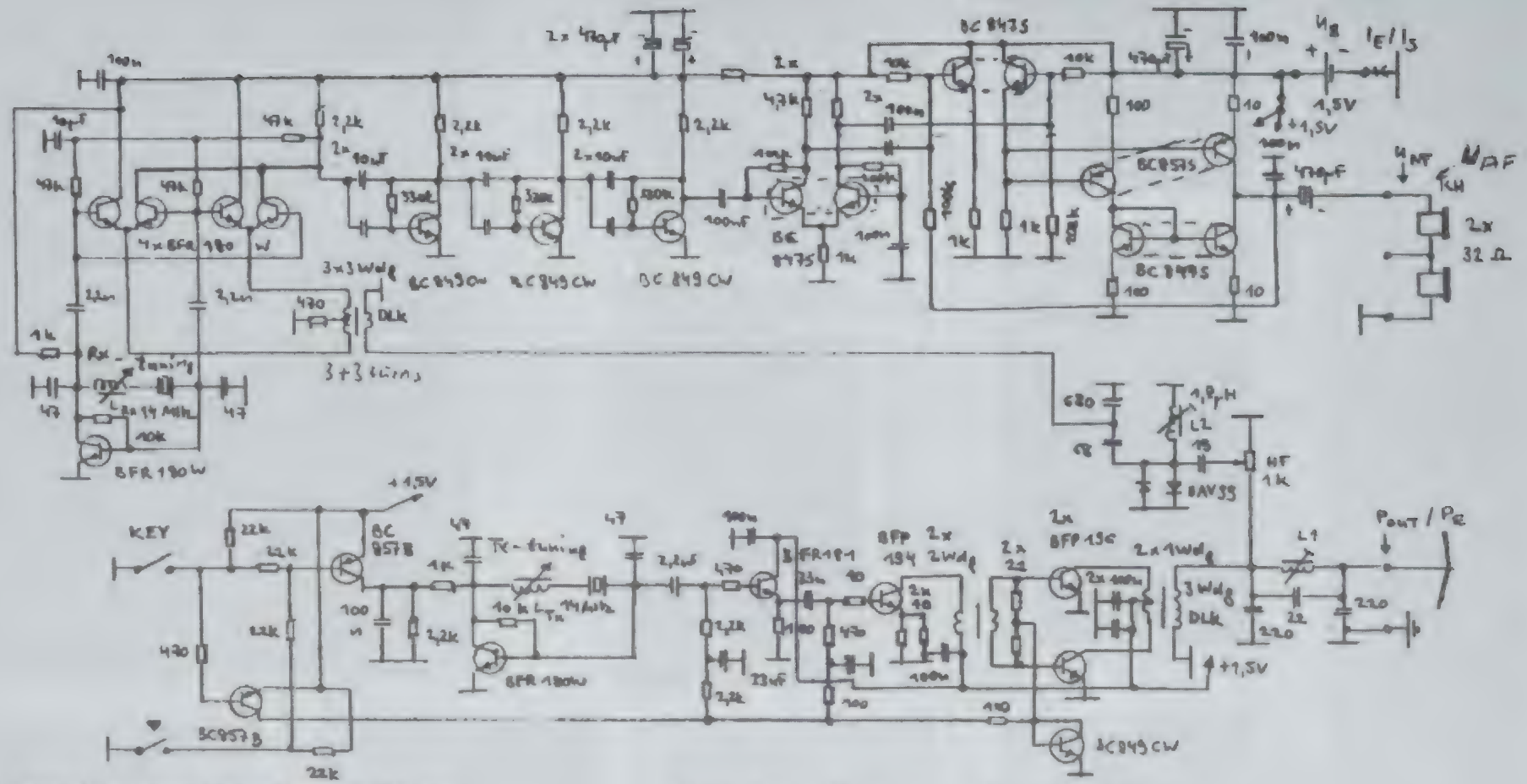
Results:

$U_{Batterie}$	I_{RX}	U_{AF-max}	I_{Tx}	$P_{out\ at\ 50\ Ohm}$
1.1 Volt	5 mA	$0.73V_{pp}$	0.2A	80mW
1.3 Volt	7 mA	$0.89V_{pp}$	0.27A	130mW
1.5 Volt	9 mA	$0.97V_{pp}$	0,33A	180mW

Gain : U_{AF-out} / U_{RF-in} = 90 dB
2^{nd} harmonic –32 dB, 3^{rd} harmonic –42 dB

What´s a txvr withot an antenna? Nothing! So we designed **The 1 Volt Antenna** matching the new transceiver. It is an ultralight high efficiency portable antenne which (if packed) is as small as the transceiver. It needs no ATU and no transmition line.

DL-QRP-AG Activity group QRP and homebrew, the German language QRP Club
Homepage: http://www.dl-qrp-ag.de
Contact: DL2FI@dl-qrp-ag.de



L1 8 turns 0,2mm enamel wire on Neosid 7.1k / 9,5nH
L2 1,8 uH Neosid 7A-04, Q=110 / 10 MHz
LRX=LTX 30 turns 0,14 mmenamel wire on Neosid 7.1k / 9.5nH
DLK=DoubleHole (pig-nose) 4,6*7,6*4mm 0,8 uH /WL

$U_{batterie}$	I_{RX}	$U_{AF\,max}$	I_{TX}	$O_{-out\ at\ 50\ Ohm}$
1.1V	5mA	0.73Vpp	0.2A	80mW
1.3V	7mA	0.89Vpp	0.27A	130mW
1.5V	9mA	0.97Vpp	0.33A	180mW

RX -3dB=600/1100 Hz -10dB=1600Hz -20dB=2000Hz

Gain RX U_{AF}/U_{RF}=90dB

Dayton 2000—Four Days In May (FDIM)
Building and Design Contests

For those that couldn't make it to Dayton this year . . . and for those that did and might have missed this. . .Here is just a taste of the happenings from the Saturday night events. Check out the QRP ARCI website for more winners and LOTS more pictures! de Mary, NA6E

1 Volt Challenge

1st Place: Duncan Walters, G4DFV

2nd Place (tied): Helmut Seifert, DL2AVH

2nd Place (tied): Charles Fletcher, G3DXZ

4th Place: James Roberts, NC9H

OPEN Contest

1st Place: Richard Meiss, WB9LPU

2nd Place: Howard Kraus, K2UD

48 Volt Challenge

1st Place: Erwin Beemer, K8EB

Box Labeling

1st Place: Bill Sepulveda, K5LN

And this very ingenious and thoughtful entry from the Cheeseheads QRP Club

Antenna and Antenna Tuner For Your Pocket
. . . Plus Test Equipment

by Helmut, DL2AVH *Eisenberger Str. 24, D-07616 Serba, Germany*
Translated from DL-QRP-Ags QRP-Report by DL2FI

It is very easy to become QRV everywhere with a powerful antenna with little effort. The only things you need are the DL-QRP pocket ATU, a piece of wire, and five minutes time. Not an unbelievable story of success, but realistic for everyone.

What philosophy is behind this project? Use a very linear, high efficient PA (e.g.DL-QRP-PA) to produce a signal with good spectral purity. Going this way, you don't need extra LPF´s between the PA and the Antenna. As a side effect (as we are not pharmaceuticals, we talk about side effects) you get smaller loss, no wastage of energy in extra toroids. The same welcome side effect we achieve if we choose the right antenna, an antenna which offers the correct base impedance of 50 Ohm without the need of extra (lossy) transformation elements.

This type of antenna has used by many radio amateurs for a long time. They are described in our antenna literature as elongated Groundplane or L-Antenna. If an Antenna has an electrical length of 0,28 Lambda, the impedance is 50 Ohm. If we reduce the length, the Impedance decreases, if we make it longer, the impedance increases.

In other words: if we measure a bad SWR at the upper end of a band, we have to shorten the antenna. It is easy to find the optimal length of the antenna this way. But it seems to be a little bit foolish to shorten an antenna using a knife every time you change the used frequency. We need a method to shorten or lengthen the antenna by another – non-destructive method. One method is the usage of a variable capacitor. If the mechanical length of a piece of wire is longer then the longest length you need to get 0,28 Lambda for a desired frequency, you can shorten it exactly to electrical 0,28 Lambda by adding a capacitor in line.

This method is the base principle of my pocket Tuner. Using a BCD switch. I switch capacitors into the line in steps of 100 pF. Fine tuning is done by a 6-to 100 pF variable capacitor. This method of coupling an antenna is absolutely non selective and therefore has nearly Zero Loss.

In practice I do not use any radials for my groundplane or L-Antenna, but I use my car as a counterpoise. That means the txvr is connected to the cigarette lighter of the car and gets its counterpoise this way. The optimal length of this antenna type differs a little bit from the length given in literature. As far as I could investigate this is dependent on the motor volume, on the number of the cylinders of the car used.

A little bit unexpected was the super efficiency of the 80 Meter version of this antenna. Using SSB at QRP level I never had the impression to use a scanty antenna on QRP. As an explanation lets have a look at the earth loss of this antenna configuration. If a single wire or a small number of radials are used as counterpoise, the earth resistances are all in a row (high loss). If we have capacitive coupling as with our car, all earth resistances are in parallel (low loss)

I did a first demonstration of this "Worlds Smallest ATU", as Peter, DL2FI named it in his 1998 August QRP column in the FUNKAMATEUR magazine, at the Ham Radio 1998 in Friedrichshafen. Several QRPers from EA, G and DL tried QSO'ing on 80m using the ATU and an L-Antenna as described. The antenna was elected using a fishing pole and only 2 meters above the ground at its opposite end. Results

Its a pity, that most QRP rigs do not have an implemented SWR- Instrument. Such a rig makes it impossible to use the beloved side effect – low loss- of the Pocket ATU for successful QRPing. To help all owners of such rigs, I constructed the SWR module SWRA 98/02. Which side of the switch shows forward or backward power depends on the way the wire is wound around the current transformer. You can easily find out by testing with a 50 Ohm resistant.

Lots of QRP rigs are too small to use a standard yAmmeter for SWR. But any kind of rig will offer at least the place for a 3mm or 5mm LED at the front panel. For this rig I constructed an SWR meter based on a red/green mixed color diode. The two signals Vf (forward) and Vb (backward) are processed by a quad OpAmp. The red LED is feed by the Vf and the green LED is feed by the difference Vf-Vb. This technique results in a broad color spectrum between red and green depending on the SWR which give a pretty good analog feeling during tuning operation. The edge points are:

SWR 1 = green
SWR 3 = yellow
SWR >10 = red

Between this we get a big number of mixed colors. To tune an Antenna, you have to trim off the red color

The second prototype was tested by DL2FI. The results are: between 10 mW and 10 watts you get very similar colors. Only the brightness of the LED is below 1 watt. A little bit lower, but still bright enough to allow smooth tuning. Peter did not find any frequency dependency between 1,8 MHz and 50 MHz

So girls and boys, that's the way: Have a close look at the losses and have more success investing lower energy and effort.

73 . . de *Helmut, DL2AVH*

Addendum by DL2FI:
QRPers can order these little ultra portable things from DL-QRP-AG via me. We offer all as a kit. We as a QRP AND hombrewers club ask you to try it, it is much easier than you think and we are afraid that homebrewing in future will be reduced to SMD kits because "parts with wires" will not be available any longer.) Prices are

50 Ohm SWR probe useable for 100uA meter OR DL-QRP-SWR Indi cator kit: 8 US$

DL-QRP-SWR Indicator Kit: 8 US$

DL-QRP-Micro Tuner for Lambda 0,28 Antennas Kit: 19 US$

Shipment by air mail to USA 5 US$, Europe outside Germany 3 US$ (per shipment, NOT per item (if you order two each for you and your friend it still is 5 US$ shipment)

Pictures of the set at http://www.dl-qrp-ag.de

Because DL-QRP-AG has no access to credit card invoice, please send money in envelope. Delivery time: 3 to 4 weeks in the moment

Small Wonder Labs PSK-20 Transceiver Kit
for PSK –31 . . . (a beta builders review)

by Rod Cerkoney, N0RC *email: n0rc@arrl.net*

Like many, I've been wanting to try PSK-31. Until now I've procrastinated, never making time to work out the details for using an existing rig. Then I was offered a chance to be a beta builder for Dave Benson's new PSK-20 kit, from Small Wonder Labs. I jumped at the opportunity.

The PSK-20 is a 20 meter monoband transceiver, simplified and specialized for PSK-31, making it very easy to get "PSK-31 active". Dave has cleverly engineered this rig to be simple to construct, easy to align, even easier to setup (no special cables to make!), and tailored to use one of the best and newest PSK-31 software packages--Digipan. The PSK-20 is available now, you can see and read about it at the Small Wonder Labs website http://www.smallwonderlabs.com/

To learn more about PSK-31 a good place to start is http://www.psk31.com/ . There you will find articles describing the mode and other useful information. Click on the "software" link, it will lead you to the home page for DigiPan where it can be downloaded. DigiPan is the suggested software for the PSK-20, but Dave tells me the rig can work with other software as well. I found DigiPan easy to learn and use. The online Help files are, well, actually helpful! You can jump directly to the DigiPan download site at: http://members.home.com/hteller/digipan/

CIRCUIT OVERVIEW

The PSK-20 is a dual conversion rig with a very wide passband, about 3.5-4 KHz. The DigiPan software handles the details about picking out individual signals from the passband. The first receive (RX) mixer converts incoming 14 Mhz signals down to 9 Mhz using a 5 MHz local oscillator (LO); that feeds a 4 pole crystal filter and IF amp. From there the signal is mixed with a 9 MHz Local Oscillator to get down to audio frequencies, which in turn are fed to your computer's sound card. The audio signal is sampled and converted into an AGC signal that controls the IF stage gain.

Going the other way, audio signals from the sound card are first mixed with the 9 Mhz LO filtered, then mixed the 5 MHz LO to produce the 14 Mhz destined for the power amplifier (PA) and your antenna. This is the clever part of the design, no complicated SSB circuits to build and align. Power out from the PA is about 3W PEP. More than enough for worldwide PSK-31 communications with even the most basic antenna. Remaining circuitry on the board handles transmit/receive (TR) switching and the RS232 interfacing to you computer. More details are available in DSW-20 manual and in a June 2000, QST article.

CONSTRUCTION

Quoting from Dave's web page, "It's [PSK-20] been streamlined for ease of construction and alignment...". All I can add is HOW TRUE IT IS! The kit contains about 220 parts, four are surface mounted, of those one is pre-mounted. The remaining three are large easy to install inductors--piece of cake, and a simple way to get your feet wet with surface mount construction.

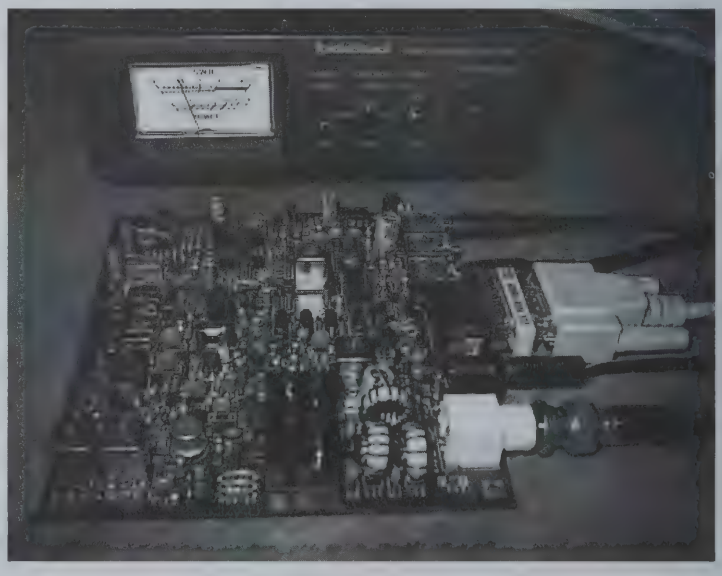
For me the parts seemed to just fall together in the nine assembly groups presented in the manual. Each group took about 45-60 minutes and that includes the time it took me to proof read the instructions for factual errors and missing steps (remember, I was a beta builder charged with this duty). Like all of Dave's kits, each group is accompanied with a detailed drawing of the board section you are working on to help locate parts. When special attention is required to mount a part or carry out an assembly sequence, all the information you need is right there in a clear and succinct manner.

The early version of the manual I was working with referenced intermediate tests to check your progress. However, the details were not available at this early stage so I can't tell you about them.

I can tell you that I did figure out a few intermediate tests of my own, like measure the output voltage of the 8V regulator installed early on. I also paused when I realized I had the receive (RX) section complete. I thought what the heck let's see what I can hear. At that time my understanding of the RX was pretty neophyte, put another way, I didn't have a clue ;-) But with a little experimenting I coaxed it into operation and was copying PSK31 transmissions from other amateur stations! Now most of us know the legends and lore of the Elecraft K2 transceiver Mojo. Well after this I got to thinking the PSK-20 has a little magic of it's own, and for some reason I thought of an old blues song/album HooDoo Woman. That did it for me; I hereby dub this "the HooDoo rig". (When you hear the audio of PSK31 signals while watching the panoramic display of DigiPan from this rig, you will understand better how well the name fits.)

For those of you who are charter member of the "Fear of toroid winding club" FEAR NOT! There are only four toroids to wind, one is a bifilar transformer with only four turns. To make it easier still, Dave chose not to use magnet wire; instead you wind the toroids with insulated solid copper wire, supplied with the kit of course. No enamel removal or tinning.... just strip away the insulation, insert into the board and solder. (My kit contained a length of "4-conductor telephone wire". The four strands are removed, each are a different color, and used to wind the toroids. When you're done you have toroids with different colored wire installed that add to the HooDoo of the rig.)

When you complete the assembly you are done. There is no chassis wiring to do. All the connectors are board mounted: audio, power, antenna...everything!



HOOKUP

Not much to say here. You connect the PSK-20 to your computer's microphone input, speaker output and RS232 serial port. The cables to do this are available at Radio Shack and other electronics parts suppliers. It's likely you have what you need at home right now. All you need are two stereo cables with 1/8" (3.5mm) plugs. The Serial cable is a DB9 on the radio side and a DB-"whatever" to match your computer. Now I know what you thinking...RS232 is a pain to find the correct cable and connector pin- out".

If you use DigiPan the problem is minimized, all you need is DTR and ground. (I enjoyed this aspect of the rig. My first job in electronics was making cables. I made hundreds. To this day I dread the task!)

ALIGNMENT

Alignment is straightforward too. Like Dave's other designs he uses tunable coils/transformers. You do the RX first. With the rig connected to your computer and an antenna you peak a coil in the RF stage for maximum audio in the computer speakers. (Just like tuning the DSW series rigs also from Small Wonder Labs) Similarly the there is a transformer in the IF stage that is peaked while listening to the audio.

The first local oscillator is then adjusted to center the "noise display" in the DigiPan screen. The second LO is then adjusted by transmitting a signal from your "big rig". This signal is visible in DigiPan as a bright line. You adjust the second LO to position that line on the correct tick mark on DigiPan's frequency display. Easy...and the process takes less time to do than it does to describe. (Check my web page http://www.qsl.net/n0rc/psk31/psk31.html for DigiPan screen dumps to see what I'm talking about.)

Next the transmitter. Connect the PSK-20 to a dummy load, press DigiPan's TX button and adjust two more coils. Each coil has it's own associated test point that you measure with a voltmeter. That's all there is to it. (If you have a wattmeter like the Oak Hills Research WM-1 or WM-2 (http://www.ohr.com/) you can use it to peak the output power while adjusting the coils.)

One more "touch of class" is a small tuning tool for the coils that is included with the kit.

A few more minor adjustments to get the audio levels set and you ready to operate.

OPERATION

Operating the PSK-20 is done from your computer via DigiPan. DigiPan is very easy to learn. It's windows based and mouse driven. One section of the screen displays all received signals, you click your mouse on one to receive it. See my web page above for a screen dump of DigiPan receiving signals off the air. When "tuned" to a signal the transmitted message appears at the top of your screen.

To transmit a message you type into DigiPan's Transmit (TX) screen, press the TX button, message sent! A macro feature of DigiPan simplifies sending of repetitive messages like CQ, signal reports, equipment lists, etc. You can even send the contents of a file or apicture. Those details I'll leave as an exercise to the reader. (Write me for assistance if you want to).

I've yet to complete that elusive first QSO. I answered a CQ from an Alaskan station, got a callback but messed up on the keyboard getting back to him. (I was in RX mode! ARRRRRGH!!!!) He moved on to another station. Similar results with a Portland OR station. Reminds me of those nervous fumbling moments of my first few Novice Class contacts. I'll get it sooner or later.

The receiver on this rig is great While tuning around the last few days I've copied QSOs from all over the USA, Europe and the South Pacific (New Caledonia!). For a frame of reference, I don't have much of an antenna. It's just an attic mounted multiband doublet.

The PSK-20 draws about 90ma in RX mode and about 600-650mA with 2-2.5W output on transmit making this a battery friendly rig. Later this summer I hope to load it, my laptop, and an antenna into the car and find some nice location in the mountains to work from.

CONCLUSIONS

In my humble opinion, "another winner from Newington", atta boy Dave. If your looking for a simple inexpensive way to give PSK-31 a try and enjoy building kits, consider the PSK-20. The PSK-20 is simple to build and get working. The software it is tailored to work with is equally simple to operate and I didn't mention this yet, **DigiPan is FreeWare!** Together they are a dynamite combo to get you into PSK31.

72/3 Rod Cerkoney, N0RC
(with edits by Jim Larsen, AL7FS, **TNX Jim!**)

Editors Note: *Since submission of this article, Rod has made many QSO's including one DX contact with a Columbian station!*

MORE FROM FDIM—DAYTON 2000 . . .

Mark Cherry, WT6P, Rev. George Dobbs, G3RJV, and Nils Bull Young, W8IJN

L.B. Cebik, W4RNL—eloquent speaker and gallant gentleman

Panel Layout Using Microsoft PowerPoint*

by Bill Sepulveda, K5LN *email: k5ln@aol.com*

Phase 1—Making the label. *(See figure 1)*

Step 1: Make an outline either using the Box or Circle Icon to match the size of the area to be covered. Rulers can be brought up in the screen window to accurately size the outline to the panel. Save the file.

Step 2: Measure the location of all holes and identify them by creating a cross hair location for the center of each hole. Do this for all holes. Save the file.

Step 3: Start labeling the functions around the areas identified for mounting components. Save the file.

Step 4: Print a copy. Cut out the label and match it to the panel. Make any corrections needed to center the information around the mounting holes.

Step 5: Save the file and repeat Step 4.

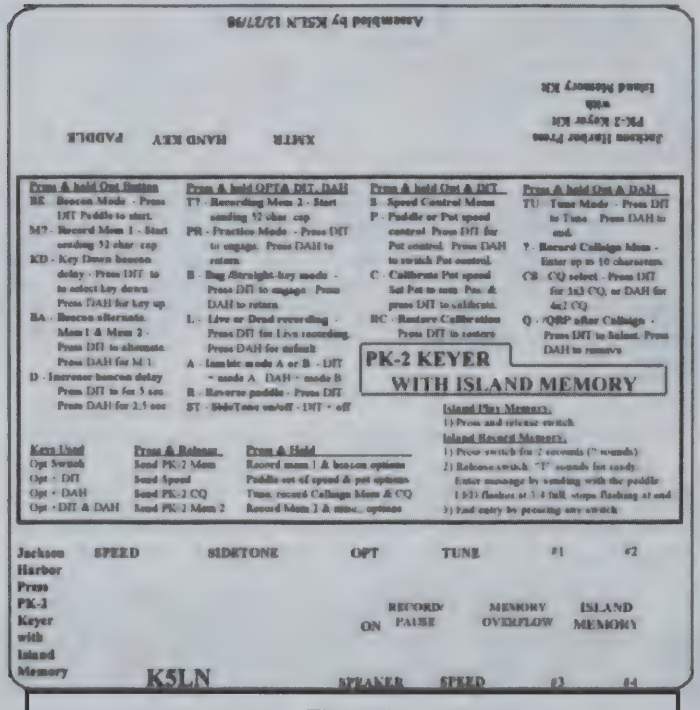


Figure 1

Phase 2—Applying label to the tape and cover. *(Figure 2)*

Step 1: Remove all hole cross hair marks from the label. Print the final label to be used.

Step 2: With the label cut out and sized, apply double-sided rug tape to the backside of the label. Rug tape comes in 1.25 inch width, so multiple pieces will be needed. Trim of the access around the edges. *(Note: rug tape is available at most local hardware stores).*

Step 3: After the tape is applied to the rear of the label the clear cover is applied. Cut the clear cover larger than the actual label, about a 1 inch overlap. Apply the label carefully to not create air bubbles. *(Note: There are two types of clear cover to use. The first type is a matte finish and is available at Craft stores and identified as a Clear Shelf-Adhesive covering. The second type is a little thicker and is a glossy clear plastic film, which is available at drafting material stores).*

Step 4: After the clear cover is applied trim off access around the edges The label is ready to apply.

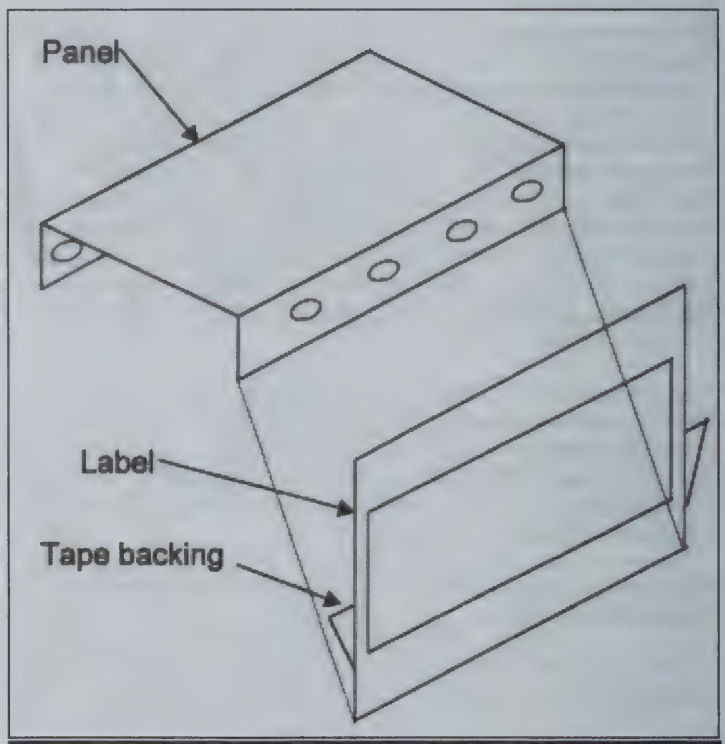


Figure 2

Phase 3 – Applying the label to the panel. *(Figure 3)*

Step 1: with the label ready to apply to the panel, remove about a half inch of paper backing from the double sided tape. Align the bottom edge and sides of the label to the bottom and side of the panel. This is best done by laying the panel on a flat surface and the edge of the label on the same surface. Gently apply pressure with your fingers to the front of the label to stick it to the panel. Now remove the paper backing on the next section of tape and slowly rub the label on the panel. Repeat this for each section of tape until the label is completely attached to the panel.

Step 2: With the label now attached to the panel, cut out the holes to remount the components. Use an Exacto knife to smoothly remove the label material in the holes.

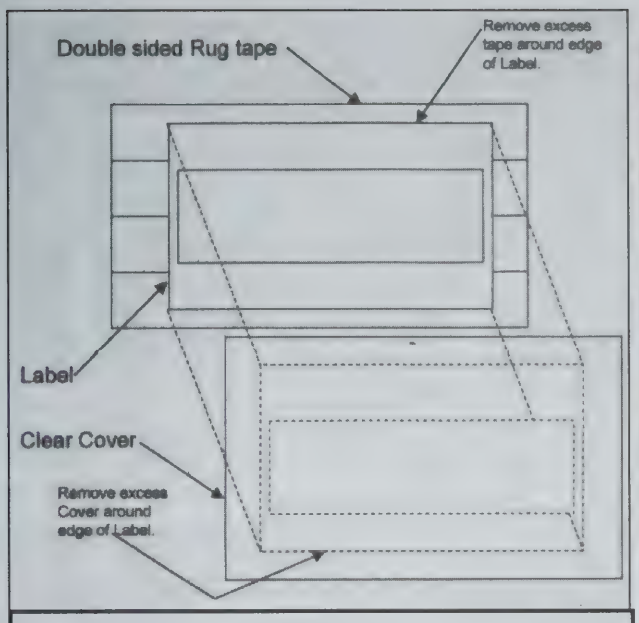

Double sided Rug tape
Remove excess tape around edge of Label.
Label
Clear Cover
Remove excess Cover around edge of Label.

Figure 3

Photo taken at FDIM Dayton 2000

Panel completed, Congratulations! The project now looks like a production piece of equipment that can be proudly displayed.

73 de Bill, K5LN

Kits - from the the small one evening "fun" kits to the high end multi-band, multi-mode transceiver.

Kanga US carries a wide range of **QRP kits** from the simple easy to build **SUDDEN** Receiver and the **ONER TX** to the **Hands Electronics RTX 210** - a multi band multi-mode microprocessor controlled transceiver. **Kanga US** imports kits from two of the major QRP kit manufacturers in the **UK - Kanga Products and Hands Electronics**. **Kanga Products** has for many years been producing kits like the **ONER** Transceiver and the **SUDDEN** Receiver. This year at **Dayton** two new kits were introduced in the **ONER** line - the **ONER Stockton power meter**, and a **ONER Keyer**. Also introduced were the **FOXX** Transceiver and the **Spectrum Wavemeter**. All four new kits sold out on Friday afternoon. All will be stocked by **Kanga US**

The **Hands Electronics** line of kits includes the only all band ssb/cw transceiver kit available with a **DDS/MCU** option. Also available are the **GQ** series of transceivers. These transceivers are extremely popular in Europe because of their excellent strong signal handling capability.

Kanga US also produces kits here in the **US**. The high performance **R1, R2, miniR2, T2, and LM-2** modules designed by **KK7B** are available. These modules can be the basis for a very high performance rig on any band between **1.8 and 1296 MHz. That's right - 160 meters to 1296 MHz - ssb, cw, am, or psk.**

For more information on any of the kits available from Kanga US, check out the web page at
http://www.bright.net/~kanga/kanga
or send $1 for a catalog to:
Kanga US, 3521 Spring Lake Dr. Findlay, OH 45840 419-423-4604 kanga@bright.net

Profiles in QRP —

Rich Arland, K7SZ
email: k7sz@epix.net

This issue we are profiling Bob Dyer (AKA: QRP Bob), KD6VIO, owner of Wilderness Radio. Bob lives in Palo Alto, California, just outside of San Francisco. I have known Bob since the early days of Wilderness. In 1996 I had the honor of sharing a tent with QRP Bob at the Zuni Loop Mountain QRP Expeditionary Force Field Day just outside of Los Angeles. About 2AM, Bob (who was operating my Sierra on the 40 meter CW position) fell off his chair and rolled outside the tent. I followed him out the door of the tent while simultaneously trying to unhook his headphones, grab his paddles and ditch the laptop computer I was logging with! We both ended up on our backsides several feet outside the tent, laughing so hard we were waking other campers in the surrounding campsites! It only happens at Field Day, folks.
Bob is a very adroit businessman, talented QRP operator and avid homebrewer. I conducted this Q & A session over the telephone with QRP Bob over the Memorial Day weekend.

Bob in the 20 Meter tent Field Day at Zuni Loop

QQ: Bob, give our readers a thumbnail sketch of your ham radio background.

Bob: I was first licensed as a Novice in 1993. Six months later I passed my Advanced Class test and after a year and a half went by, I upgraded to Extra.

QQ: You and I have chatted quite a bit over the years. I know that you are 100% QRP in your shack. Exactly when did you know that QRP was the path you wanted to pursue?

Bob: Actually I was a dedicated QRPer from the beginning. QRP operation came about out of a sense of practicality. I had no money and could not afford to purchase a radio. At that time a "fortune" was anything over fifty bucks! I was an avid SW Listener and had a decent receiver. After reading Ade Weiss' "Joy of QRP" several times and becoming intensely interested in homebrewing, I started building my QRP transmitters and mating them to my SW receiver. W1FB's "QRP Notebook" furnished me with my first QRP transmitter, the Mighty Mite. No one told me that 50 milliwatts was a little on the light side for a neophyte QRPer, so after several weeks of calling "CQ" and finally getting a QSO, I was really hooked!

QQ: What drew you to QRP?

Bob: The challenge and, as I said before, lack of money. "Joy of QRP" helped me set goals and kept me focused during the early days. I had QRP WAS in six months and DXCC in a year and a half. At this point, let me say that these operating feats were accomplished using homebrew transmitters, a Ten-Tec Argonaut 515, a SW receiver and wire antennas. I lived in an apartment so the antenna situation was critical. Later I added a GAP vertical to the wire antenna farm.

QQ: Seemingly every time we talk, you have a new QRP DX tale to tell. Share with us your passion for QRP DXing and tell us about your

Bob: My current country total stands at 223 worked using five watts or less. About 70% of these contacts were done on CW with the remainder on SSB. My passion for QRP DXing stems from my desire to see how far I can push the envelope. I absolutely love the challenge of DXing with low power. After a while you develop a sense of when and where you will work the DX. You instinctively know which pileups you can bust and which you can't. In essence you pick your fight (pileup) and go after the DX station. I remember when I was looking for Yemen. Each night I'd hear the weak 7O station working this HUGE pileup. I didn't even try. Conversely, when a Vietnamese station appeared on the bands, I dogged him for two weeks and FINALLY got in his log after busting a fairly large pileup. The 3W station was reasonably loud and the pileup was defined, so I knew I stood a better than average chance of bagging the DX.

QQ: Seemingly contesting and DXing go hand in hand. Do you get involved with QRP contesting?

Bob: Contesting, yes. QRP Contesting, only enough to hand out a few q's to other qrpers. I'm not a big QRP Contester. However, during the big "world wide" contests I do get on and give out a few points. I use the Search & Pounce (S&P) technique and I dramatically increase my DXCC country totals in this way. I do participate in qrp contests, but find most qrpers seem not to have very good ears (marginal antennas? I think) and I usually hear many more than can hear me which I find frustrating. As we both know big gun contesters have excellent antennas and ears, which is why I have gotten as far as I have. Tip for would be qrp-dxers, at the last couple of hours of a big contest all the big guys have worked each other and are now desperate for any new contacts...even from a qrp station! It can be like "shooting ducks in a barrel!"

QQ: Let's shift gears and talk about your other passion in QRP, Wilderness Radio. Tell us about how Wilderness Radio started.

Bob: At the very first NorCal club meeting, I was introduced to Wayne Burdick, N6KR, who was demonstrating his Safari-IV, multiband QRP transceiver. I commented to Wayne that I thought that there was a market for multiband QRP rigs. MAN, was I ever right! About a year and a half afterward, Wayne called me and wanted to know if I wanted to start up a business marketing some QRP rigs he was designing as club projects for NorCal. I told him that he'd gotten the wrong guy, as I was unemployed and broke! That didn't seem to matter to Wayne, and in 1995 we shipped our first NorCal-40A (NC-40A) monoband 40 meter kits under the Wilderness Radio banner. In December of that year we started shipping the first Sierra kits. Our initial desire was to sell enough NC-40As to afford to kit up the first batch of Sierras. We used the NC-40A sales to front the money for the Sierra kits. The rest is history.

QQ: About how long does it take to design, prototype and finally market a rig like the Wilderness Sierra?

Bob: Actually, Wayne had been designing the "ultimate portable QRP rig" for about 15 years. Wayne is a gifted engineer. Given a task, he works it from start to finish in a matter of days! In the case of our KC-1 keyer/digital audio frequency counter, Wayne designed the KC-1, in his head in about 3 or 4 hours. He had a working prototype within a week. It's been one of our best selling kits.

QQ: Without a doubt, the Wilderness Radio product line is extremely successful. I understand that the NC-40A has a life all it's own outside the QRP community. Please explain.

Bob: Dr. David Rutledge, a professor at Cal Tech, ordered a 40A. Two or three months later, he called me and wanted to use the NC-40A as a teaching device for his Electrical Engineering students at Cal Tech. Initially they bought 20 or so kits, but then wanted us to just supply the PC boards. Wayne and I agreed and now we furnish the board and the students get their own parts, build the rig, get it working and then write an analysis of their work as an engineering project. Dr. Rutledge has written a book, "The Electronics of Radio" (ISBN: 0-521-64136-5, published by the Cambridge University Press) which is an excellent teaching text based upon the NC-40A. If you visit the Wilderness Radio website (www.fix.net/~jparker/wild.html) and go to our NC-40 page, there is a description of the book and a link to the publisher, should anyone care to order one.

QQ: When I was out at the Zuni FD in 1996, I noticed you had several other hobbies that might be of interest to our readers. Please elaborate.

Bob: I am an avid bird watcher. This started when I was only 10 years old. I am intensely interested in bird watching and find it extremely challenging. To date I have seen, first hand, over 2400 species of birds. This is about 25% of the world's birds.
About the same time I started bird watching, I also became interested in amateur astronomy. I now own more telescopes than any one human should be allowed and have no dark sky to use them! One of these days I'm going to buy a parcel of land away from all the light pollution and start enjoying all my telescopes!

QQ: Thank you very much for taking the time and sharing your thoughts on QRP with us, Bob. One final question regarding DXing and the DXCC award: do you feel that the ARRL should offer a QRP endorsement to their DXCC award for those of us who pursue DXing at the QRP power levels?

Bob: A very strong "YES!" to that question. Actually, I never understood why the ARRL didn't do this from the beginning. QRP has become vastly more popular in the last several years and those who accomplish DXCC with low power deserve the proper recognition.

Top to Bottom: The SST, The NC40A, The Sierra, The EleCraft K2

QrpBob, KD6VIO
Owner, Wilderness Radio
650-494-3806
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website: http://www.fix.net/~jparker/wild.html
snail mail: Wilderness Radio,Pob 734, Los Altos,CA 94023-0734

Till next time . . . 73, Rich K7SZ

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NorCal SMK-1 Kit Review

by Mike Czuhajewski, WA8MCQ *email: wa8mcq@erols.com*

NorCal has done over ten thousand kits since they started, and Doug Hendricks (KI6DS) has sourced the parts for every last one of those. He has a good feel for what's available on the surplus components market, and for what's getting harder and harder to find. Unfortunately, he's known for some time that a lot of through-hole parts (those with leads on them) are becoming harder and harder to get. On the other hand, surface mount parts, known generically as SMT, are more and more widely available on the surplus market.

Seeing the handwriting quite clearly on the wall, Doug decided that it's high time QRPers start learning how to build things with surface mount parts since it's part of the future. The surplus market is indirectly driven by what industry wants and needs, with things like computers and cell phones going to surface mount parts in a big way. The automated equipment ("chip shooters") needed to place the components onto circuit boards are hugely expensive, but once you have them up and running and can spread the setup costs across millions of circuit boards, SMT becomes very attractive on the bottom line. More SMT and fewer leaded parts used in industry translate directly to fewer leaded parts making it onto the surplus markets. The bottom line is that we need to start getting used to them, because they ARE coming.

"A Learning Tool For Surface Mount Construction Kit Building"

NorCal announced some time ago that they're working on a full-featured transceiver for 10M using SMT, which should be available later this year. (And then after the NorCal kit finishes it's run, it will be put out by someone as a commercial product on 12, 15, 17 and 20 meters.) But in the meantime, Doug threw out a question on QRP-L, the Internet QRP discussion forum—would anyone be interested in a simpler kit to be made before that, to be a learning tool to get used to building with SMT? The response was overwhelmingly positive, resulting in the $30 (plus shipping) SMK-1 kit. (The phrase in quotes above is the subtitle of the instruction manual.)

Doug engaged Dave Fifield, AD6A, to design a nifty little starter rig that makes a great learning tool for getting your feet wet in SMT building and makes an excellent stepping stone to bigger and better things. (Rather, make that "to more complicated and better things!" The SMT parts used in kits will only get smaller, never bigger.) And since Doug intends this as a learning experience, he says that NorCal will continue to make them available for a good while. You don't have to worry about them being sold out by the time this issue hits the streets, which is always a potential problem with anything that is announced on the Internet.

Quite a number have been built already and put on the air, and QRP-L has been filled with reports of success. The feedback flying around indicates that while there is a learning curve, most people are finding that it's not that hard to build with SMT parts at home once you get the proper tools and techniques. And most folks indicate that it does indeed make a fine way to get your feet wet with SMT.

What design shall we use?

Doug thought about the simple Tuna Tin 2 transmitters and MRX receiver kits that NorCal had for Pacificon, how people loved them and had come up with several modifications to improve the performance, and the combination seemed a logical choice for a simple rig. This is essentially what they went with for their new SMK-1 kit, a single cuits on a single board, each with it's own 40M crystal (7040 kHz) which can be VXO'ed independently of each other.

The transmitter uses a pair of 2N2222A transistors, a VXO driving a class A power amplifier. The receiver uses an NE602 followed by an audio amplifier chip. Most of the SMT parts are the relatively large 1206 size, making them easier to work with than a lot of the other SMT sizes. There are also 3 integrated circuits, in SMT form. The photo of Figure 1, courtesy of N5IB, shows the unit. (Although shown with knobs, they are not included in the kit.)

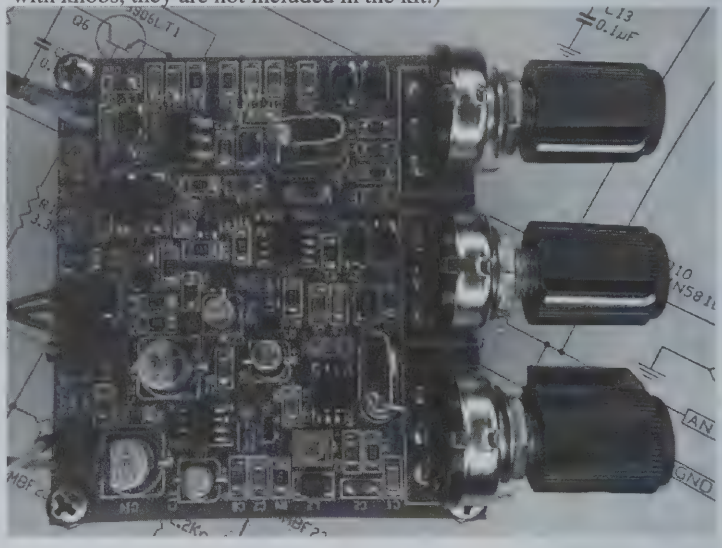

Figure 1: The NorCal SMK-1 surface mount transceiver N5IB photo)

The 1206 designation comes from the dimensions, which is 120 mils—thousandths of an inch—by 60 mils, or 0.120" X 0.060". Another common size is 0805, and on the far end we have 0402 parts, which are 40 X 20 mils. I've been working with the latter for a few years, and those definitely require a stereo zoom microscope! Although I haven't seen any yet, there is now an even smaller size—0201, or 0.020" X 0.010"; Digikey carries some of those, but I'm in no hurry to start using them!

Here are some of the specifications:

350 milliwatts output, with 1.48 kHz TX range
-120 dBm sensitivity, receive frequency range 4.25 kHz
Full electronic QSK, without switches or relays

The exact frequency range may vary from unit to unit, of course, depending on individual component characteristics. Further information on the SMK-1 can be found on the Red Hot Radio web site at

http://www.redhotradio.com/

and click on the NorCal SMK-1 button. You can also find a copy of the schematic there, as a PDF file. (The Adobe Acrobat reader is required to view PDF format files and is available free online. Go to

www.adobe.com

Click on PRODUCTS, ADOBE ACROBAT READER, then proceed with the download for your particular computer system. Although individual versions are free for online download, you can also purchase a CD ROM that has all 50-plus versions for various computer systems.)

The SMK-1 is entirely surface mount with a few exceptions;

Everything else is SMT. There's also one toroid that you have to wind, but it's mounted on top of the board as if it were a surface mount device—a home-made SMT part, as it were. The total parts count is about 80. You provide your own off-board parts, such as case, knob, jacks, etc. And the New Jersey QRP club even has a kit that provides for that!

The circuit board, designed by AD6A, is quite nicely done and absolutely first rate. And, in honor of his being the proprietor of Red Hot Radio, they had the PCB company make them red. (When you're the designer, you're allowed to have a bit of fun.)

Building the kit

To work with SMT parts, you'll need a soldering iron with a small tip, tweezers, and it certainly doesn't hurt to have a magnifying device of some sort—a handheld lens or one of those magnifying visors. The manual has some suggestions on working with the SMT parts. Myself, I have access to stereo zoom microscopes at work that make building with SMT a true pleasure. While not mandatory, it can also be helpful to have something to hold down the parts before soldering them. A number of devices to do that have been described on QRP-L, and I've included some info on that in the Idea Exchange in this issue.

Since SMT parts are very small and the markings can be difficult to read, depending on your eyesight—and some are not marked at all—packaging the parts in a kit can be a problem. They have to be easy to find and identify. When the KnightLites did their SMITE surface mount Pixie rig a few years back, they taped the parts one by one onto a large drawing so you knew exactly where each one went. Doug came up with an equally ingenious method for the SMK-1, shown in figure 2. I thought it was so neat that I couldn't bring myself to open the bags and start building for a couple days. I had to keep sneaking a peak at the bags of parts every now and then, and admire the ingenuity!

He starts with the plastic envelopes he already has (A). Next, he takes a heating tool and runs it down the length of the bag in two places (B), melting the plastic and forming three tubes. Next, he drops parts into each tube (C); since there is more than one bag, and to make sure you view it from the proper side, the lower left has a piece of paper which identifies the bag. After all 3 items are in place, he runs the heater along the bag just above (D), creating 3 sealed compartments.

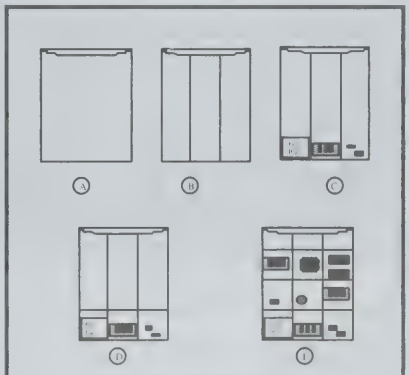

Figure 2: Bagging the SMK-1 parts

The whole process is repeated a line at a time, and the final result is shown at E. The bag now has a large number of SMT parts, all in their own compartment. (The actual bags have seven rows, and there are two bags.) The manual has drawings of the bags, which identify the parts. When building the kit, you carefully slice open a compartment, install the parts as directed, and then move on to the next one.

Ordering the SMK-1

If you'd like to order an SMK-1 please send a check for $34 ($30 for the kit plus $4 for shipping and handling) made payable to Jim Cates and send it to: Jim Cates, 3241 Eastwood Rd., Sacramento, CA 95821 Please include a self-addressed mailing label. It can be simply your name and address typed on white paper.

The NJQRP enclosure kit

You supply your own enclosure, jacks, knobs, hardware, etc. If you prefer, you can buy a kit from the NJ QRP club containing those items. Figures 3 and 4 show the SMK-1 in the NJQRP enclosure. Here's the info from their web site:

Included in the SMK-1 Enclosure Kit

- 8 precision-cut, pre-drilled copper-clad pc boards which, when soldered together as instructed, form the enclosure
- 3 knobs (for the pots included on the SMK-1 PCB from NorCal);
- Rear panel hardware: two 1/8" audio jacks, a 2.1 mm coaxial DC power jack, and a BNC connector;
- 2 small screws to hold the top half of the case to the bottom;
- 4 small screws and two nylon spacers to hold the SMK-1 PCB in place;
- 4 rubber feet
- pre-printed front and rear panel labels on clear acetate, suitable for gluing to the enclosure to give it a professionally finished appearance; and
- a 10-page, detailed instruction manual to guide the QRP homebrewer through construction and finishing of the SMK-1 Enclosure.

Price and Ordering

The SMK-1 Enclosure can be purchased for $10 from the NJ-QRP Club. This price includes shipping anywhere in the world. Send cash, check or Money Order payable to "George Heron, N2APB" and mail to: George Heron, N2APB
2419 Feather Mae Court
Forest Hill, MD 21050

You can find more information at the NJ QRP web site:
http://www.njqrp.org/smk-1/index.html

Figure 3: Front of SMK-1 in NJQRP enclosure kit (NJQRP photo)

Figure 4: Rear of SMK-1 in NJQRP enclosure kit (NJQRP photo)

Summary

The SMK-1 is not a complex, full featured rig by any means, and NorCal is the first to admit it. It's a pair of simple but proven circuits that are well known in the QRP community. It's a very QRP transmitter, under one watt, and with a direct conversion receiver. And a huge number of people have had a lot of fun with both of those circuits individually over the years. The main purpose of the kit is to be a learning tool to introduce people to SMT construction, and it serves the purpose very well indeed. While some non-QRPers may make fun of "toy radios," I find that's where half the fun of QRP is! Small, simple minimalist rigs will always be a popular part of QRP, and here's one that's even educational. I had a blast!

--qrp--

FDIM . . .

S. Felton "Mitch" Mitchell, W4OA, President of Vibroplex presenting Code Warrior Keys serial number 1 and 2 to Wayne Smith, K8FF

L-R, Ken Evans, W4DU, FDIM Chairman, Peter DL2FI and Jim W4QO , QRP-ARCI President

"Building Contest Judges"

Preston Douglas, WJ2V; Mike Branca, W3IRZ and Rev. George Dobbs, G3RJV

Jim Kortege, K8IQY and Wayne Burdick, N6KR

"The Banquet"

Banquet quest speaker Wayne Burdick, N6KR

. . . and Dayton 2000

QRP-ARCI booth in the Arena. L-R are Thom Durfee, WI8W, Preston Douglas, WJ2V and Hank Kohl, K8DD

L-R, Leonard Young, KS4RN: Joyce N2PTW and Les K4NK Shattuck and Mike Branca, W3IRZ of NoGaQRP at ARCI booth

Andy, KC8KFI and Eric, WA6HHQ reviewing the K2 warranty.
(photo couresy of Diz Gentzow, W8DIZ)

Andy KC8KFI receiving an award from Jim W4QO for technical merit. The award was a K2-ATU donated by Elecraft
(photo couresy ofDiz Gentzow, W8DIZ)

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[1] 40 and 20 meters standard, others available.

Modifications for MFJ QRP-Cub Transceivers

Larry East, W1HUE *Idaho Falls, ID* *email: w1hue@arrl.net*

Introduction

The MFJ QRP-Cub series of single-band transceiver kits are fun little rigs to build. Most of the components are "surface mount" type and already installed. The remaining "through hole" components can be installed very quickly – and there are only two toroids to wind! Output power is on the order of 1 to 3 watts, depending on the band model. The design is quite basic and there are no "frills" such as RIT, frequency enunciator or built-in keyer. AGC (audio derived) is included, however.

I purchased a 15M kit mostly out of curiosity; considering the assortment of QRP rigs that I have including a recently completed Elecraft K2, I really don't need another radio! As soon as I had it up and running, I found a few things that I decided needed "improving". In particular, I found that the receiver recovery time was too long for my tastes. The tuning range was about 62 kHz, and I found that tuning with a single turn pot was very touchy. The "fixes" for these and a few other items that I implemented in my Cub are described in this note.

Tuning Linearization

As is common with varactor tuned VFOs, the Cub tuning is not very linear; frequency spacing (i.e., kHz/degree of tuning pot rotation) is quite a bit finer at the low end of the VFO tuning range than it is at the high end. The tuning linearity can be greatly improved by simply placing an appropriately sized resistor from the wiper of the tuning pot (R4) to the "cold end" of the pot (the end that connects to R5). This connection is shown in **Fig. 1**. The "appropriate size" depends on the particular band model that you have, but a good starting point is 4.7K. There are extra holes for the pot connections, so it's very easy to solder a resistor to these holes on the bottom of the board. Probably the best approach is to tack-solder in a 10K pot, adjust it until you get approximately the same frequency spread on the first and second half of the rotation of R4, measure the pot value, and replace it with a resistor that comes closest to the pot value.

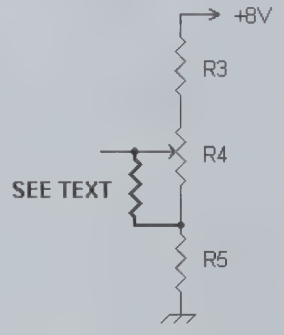

Figure 1. Resistor added to Linearize tuning.

The shunt resistor will reduce the total tuning range somewhat, perhaps 10 kHz or so for a resistor in the 3-5K range and more for a smaller resistor. (There will be less effect on the 30M model since it has a smaller initial tuning range.) The tuning range may be further reduced, if desired, by paralleling a resistor across all of R4. As noted above, my 15M CUB had a "stock" tuning range of 62kHz, which caused the tuning to be much too sensitive for my liking. By paralleling R4 with a 10K resistor and placing a 4.2K resistor from the wiper to the "cold" end, I obtained a 41kHz tuning range; 22 kHz are covered by the first half of the pot rotation and 19 kHz by the second half.

"True QSK" and Related Changes

I made changes to the keying circuit to reduce receiver recovery time and improve the transmitter keying envelope. I also added a pot to adjust the sidetone level. These changes are interrelated and should be performed together.

No circuit board traces need to be cut, but one surface mounted resistor must be removed. Only six additional parts are required:

- 2N7000 FET (Mouser Part No. 625-2N7000)
- 10µF 10V tantalum capacitor (Mouser Part No. 74-199D10V10)
- 0.22µF small ceramic capacitor (Mouser Part No. 581-UEZ224K2)
- 2K 1/4-in. (7mm) square potentiometer (Mouser Part No. 72-T70YU-2K)
- 10K 1/4 W resistor
- 2.2K 1/4W or 1/8W resistor (1/8W preferred)

Note: Mouser part numbers are examples only; equivalent parts from other sources can certainly be used.

It is not absolutely necessary to remove the board from the case, but it is probably more convenient to do so. A good magnifying lamp and/or "cheater glasses" will be very helpful; but if you are like me, you needed those to build the kit in the first place!

Start by removing R30. This is a 4.7K SMT resistor located near the right-rear edge of the PC board (near C34). You can take the brute-force approach, break the resistor in two with a pair of small cutters or diagonal pliers, and then remove the pieces from the pads with desoldering wick. Or, with a little effort, fine desoldering wick (0.020 – 0.030 in.) and a small prying tool (like a Dentist's pick), you can remove the resistor in one piece. First, remove as much solder from both pads as possible using desoldering wick. Then gently pry up on the resistor as you heat one pad and then the other. The resistor should pop off in one piece.

Next prepare and mount the 2K trim-pot; this will be the sidetone level control. Prepare the pot as follows: Looking at it from the rear, bend the left-hand lead over to the center lead, wrap it around the center lead and solder it. Trim any excess wire from the left-hand lead (*not* the center lead; you need it full length.) If the style of pot that you have has the three leads in a straight line, then the up/down orientation of the pot is not important. If the center lead is closest to one edge, orient the pot with the center lead nearest the bottom edge before making the above connection from the left-hand lead.

Now comes the somewhat tricky part: mounting the pot on the board. If you look just behind and between L1 and L2, you will see a plated-through hole in the board just behind C13 and between Q1and C31. This connects to the ground plane on the bottom of the board. You want the center lead of the pot to go through this hole, with the pot sitting on top of C19 and C31. Be very careful not to short anything! Once the pot is properly positioned, solder the center lead in the ground feed-through. The pot can be kept in place by applying a little bee's wax to top edge of the pot nearest Y1, then use your soldering iron to melt the wax to secure the pot to Y1. You can also use hot glue (or some other adhesive), but bee's wax is very easy to remove without damaging anything if the need should ever arise.

Next comes the 2N7000 FET. This is used to reduce the transmitter feed-through in the receiver by shunting the signal on the base of Q1 to ground. The amount of feed-through, and hence the sidetone level, is controlled by the 2K pot. When you are finished, the circuit will be as shown in **Fig 2** (the three added components are shown in **bold**).

Prepare the 2N7000 as follows: With the flat side of the transistor facing you and the leads pointed down, bend the left-hand lead up beside the transistor body. Bend the center lead up in front (the flat side) of the transistor. You now need to carefully solder the remaining lead (the right-hand one, which is the drain lead) to the front pad of R9 (the pad that connects to C17 and Q1). Shape the lead so that a short section will just fit over the solder pad of R9. The bottom of the transistor should be about 3/16-in. above the board. The left-hand lead (the source lead) will be attached to the free lead of the 2K pot. After you have the two outside leads of the FET properly trimmed and bent into position, solder the drain lead to the front pad of R9 and the source lead to the lead from the pot. The gate (center) lead will be sticking up in front of the FET. **Note:** use a small soldering iron tip and relatively high tem-

perature (750-800 degrees F) when soldering to the R9 pad and be quick! Hold the wire from the FET on the pad and touch the iron to the lead only long enough for solder to flow from the pad to the wire. After you have secured the FET in place by soldering the other lead to the pot, you can use a little solder if necessary to touch up the connection to the pad. Again, leave the iron on the pad only long enough to get the solder to flow. If you get too much solder on the pad, remove the excess using desoldering wick.

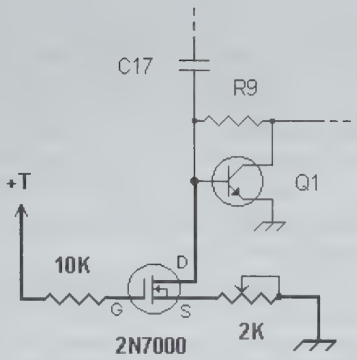

Figure 2. Components added for adjustable sidetone.

Next, locate the two feed-through holes between R19 and C27. The hole nearest R19 connects the "+T" line from the top to the bottom of the board; this is the one that you want. The 10K resistor connects between this hole and the gate (center lead) of the 2N7000. Bend one lead of the resistor at a right angle about 1/4-in. from the resistor body. Feed the bent end of the lead into the hole and trim the other lead so that it can be soldered to the gate lead of the FET. The resistor should be positioned about 3/16-in. above and parallel to the board. (If you did not remove the board from the case, trim the bent resistor lead so that it will not extend below the board and short to the case. Otherwise, you can trim the lead after it is soldered.) Solder the resistor in place and trim any lead excess.

Now solder the 2.2K resistor between the front of R28 and R29 (immediately to the left of C27). The pads to which you will solder the resistor are the ones that connect to Q8. The resistor should be positioned on top of R28 and R29 with the leads bent to touch the two solder pads. A 1/8W resistor works best for this, but a 1/4W one can also be used. Again, be careful not to heat the pads to long or be sloppy with solder.

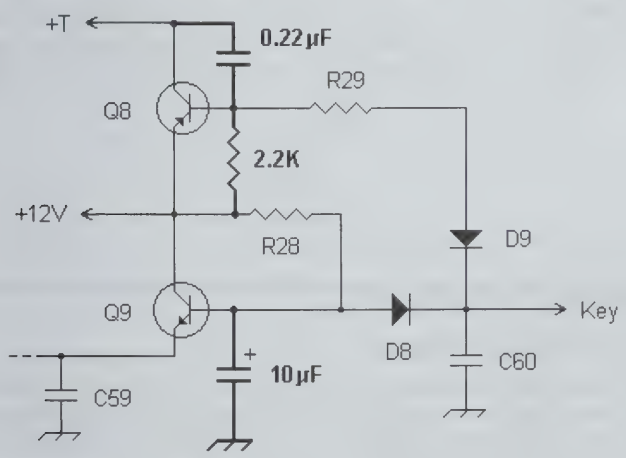

Figure 3. Modified T/R keying circuit. Added components are shown in bold.

When you have the 2.2K resistor in place and the leads trimmed, solder the 0.22µF capacitor between the front pad of R29 (the same one to which the 2.2K resistor is attached) and the lead of the 10K resistor that passes through the PC board. The 2.2K resistor and 0.22µF cap are used to shape the rise and fall time of the CW keying waveform. Without these components, the CW envelope rise-time is very fast (about 0.1ms) resulting in minor but noticeable key-clicks. With these added components, the CW envelope rise and fall times will be about 2ms yielding very nice sounding keying.

Now all that is left to do is solder the positive lead of the 10µF cap from the pad of D8 that connects to Q9 and R28 and the negative lead to ground. For the ground connection, use the feed-through hole between D5 and C60. The new Q8-Q9 switching circuit will be as shown in **Fig. 3** (added components are shown in **bold**).

The 10µF cap ensures that the T/R switch (comprised of D4-D7) remains off a few milliseconds after transmitter output decays to zero so that no "thumps" or "clicks" will be heard in the sidetone. However, the receiver will still recover very quickly allowing full QSK operation.

The long recovery time of the receiver in its stock form was due to the AGC being blocked during transmit by a voltage applied to it through R30. However, if you just remove R30, the sidetone will be extremely loud and will still activate the AGC. The FET shunt from the base of Q1 to ground eliminates this problem.

Carefully check your work for solder splashes, connection errors, etc. When you are satisfied that all is well, set the 2K pot to the middle of its range, connect the rig to a power source, key, dummy load and headphones. Apply power and key the rig; the sidetone should not have any "clicks" or "thumps" and the receiver should recover almost instantaneously on key-up. If not, then it's time to retrace your steps! If all is well, set the desired sidetone level with the audio pot set for a comfortable level for receiving and enjoy true QSK operation!

After making this mod, I noticed that the transmitter is momentarily keyed when power is switched on. I did not notice if this happened before making the mod, but I suspect that it is being caused by the 0.22µF cap that was added between the base and collector of Q8 charging through the 2.2K resistor when power is applied. My NorCal 20, which has a similar keying circuit, also produces a power-on transient. The transmitter is keyed for an extremely short time (a few milliseconds) and I decided that it is not worth worrying about.

VFO Warm-up Drift

Some Cub owners have noted significant warm-up frequency drift, whereas others see very little drift. Such variations are to be expected due to the normal production tolerances of the parts used in the VFO.

The major sources of possible drift in the Cub VFO besides the inductor and capacitors used in the circuit are the "tuning diode" (D2, an MV2104) and the SA602 mixer (U2) which is also used as the oscillator. Slug tuned inductors (and inductors wound on powdered iron toroids) usually have a positive temperature coefficient, causing the oscillator frequency to decrease with temperature. Most capacitors have a negative temperature coefficient, so the proper choice of capacitor size(s) and type(s) will almost exactly compensate the temperature drift of the inductor; this is the reason that a combination of polystyrene and ceramic caps are used in the Cub VFO circuit. The capacitance of the tuning diode is a small part of the total VFO circuit capacitance, hence its contribution to drift is small. The contribution of the SA602 to the VFO drift can, however, be significant. Unfortunately, the thermal properties of '602/612 mixers vary from device to device making it impossible to come up with a temperature compensation scheme that will work in every case. (That's why a separate transistor VFO is used in more complex rigs utilizing these mixers.)

In its "stock" form, my 15M Cub would drift down about 2 kHz during the first 10 minutes after a "cold start" and another 300-500 Hz over the next 5 minutes. It then settled down and would maintain a set frequency within a couple of hundred Hz or so over the next hour or two – provided the ambient temperature remained relatively constant.

Since temperature compensating a VFO can be a long and frustrating exercise, I tried to convince myself that this was "good enough". However, after several QSOs during which I was continually "tweaking" the dial, I decided to bite the bullet and see if I could improve the situation. Well, I was very lucky; after a few hours (rather than a few days) of diddling with different capacitor combinations, I was able to

reduce the drift to almost zero! The VFO now wanders up and down about ±50 Hz during the first 10-15 minutes of warm-up, and then changes no more than ± 25 Hz during any 10-minute period. In one test, I left it running on the bench for four hours and the total drift was only 90 Hz. It did drift up and down some during that time, but never the less, this is a ***big*** improvement over the original drift!

The improvement was achieved by replacing C6 (originally a 150pF "mono cap") with three caps in parallel: A 100pF NP0 mono ceramic, a 10pF N900 disc ceramic and a 39pF NP0 disk ceramic (the two disk caps are soldered on the bottom of the PC board). For those not familiar with capacitor designations, "NP0" caps have very low temperature drift; typically less than ± 100 PPM per degree C. (The "mono" caps used in the Cub are supposed to be NP0.) "N900" means that the drift is "nominally" a negative 900 PPM per degree C. As explained above, this combination of capacitors may ***not*** work for your 15M Cub, and certainly not for other band models. If you want to try your hand at reducing the warm-up drift in your Cub, there are some suggestions for stabilizing VFOs in the "Idea Exchange" column elsewhere in this issue.

Odds and Ends

Resettable Fuse

The "fuse" in the Cub is simply a trace on the PC board that is supposed to open under high current conditions. (Look for a "zigzag" trace near the power connector.) There are solder pads at each end of the trace so that a #30 wire jumper can be installed should the trace ever open. You can also cut the "fuse trace" and install a real fuse, such as a 0.5A subminiature axial lead type, using these solder pads. I chose to install a "PolySwitch" resettable fuse so that I won't have to bother with replacing it should I ever have an over-current condition (caused, for example, by a reverse power connection). These are solid-state devices that have a very low resistance until a current threshold is reached and then the resistance becomes very high. They will remain in the high resistance state until the over-current condition is corrected. Slick. These devices are fairly inexpensive and available from Digi-Key. The part number for one that will trip between 0.5A and 1A is RXE050-ND.

Tuning Calibration

Unless one uses an external frequency counter or other measuring device, determining the Cub's operating frequency is pretty much a matter of guesswork. There is not even a "logging scale" for the tuning dial that one can use to make a calibration chart. (Dial tick-marks are shown in the picture of the Cub on the ARCI web site, but apparently those didn't make it into production...) I like to know where I am operating, so I decided to make a "custom dial" using an inkjet printer and clear self-adhesive film. The film that I used is called "Repro Film" manufactured by Rayven Inc. This and similar film can be obtained from stationary stores and copy centers. I find it very useful for transferring lettering to panels. After the film is applied to the panel, I coat it with a clear acrylic spray coating.

Increased Power Output

My 15M Cub puts out about 1.2W when powered from 13.6V. The manual states that power output can be increased somewhat (up to 20%) by using a different RF power transistor in place of the 2N5109 supplied with the kit. I tried two different 2N3553's and one 2SC799 and did not see any significant improvement. The output was slightly less with one of the 2N3553 and slightly more with the other compared with the stock 2N5109. The output from the 2SC799 was significantly less at about 0.8W. The 2N3553 with the greatest output (about 1.3W became unstable when I accidentally keyed the rig with no antenna connected. I found no indication of instability with the other '3553, the stock 2N5109 or the 2SC799.

I suspect that there is not enough drive, especially on 15M, to provide much more output than can be obtained from the stock 2N5109 (an MRF237, however, might provide a little more output because of its higher gain). The little surface mount PN2222A driver transistor could perhaps be replaced with a more robust 2N2222A, 2N4401 or 2N3904 to provide a little more gain, but I didn't try that.

My personal opinion is that any power increase obtainable by hand picking driver and final transistors would likely be less than 50% and not worth the effort. Any contact that can be made with 1.5W can probably be made just as well with 1.0W. Keep in mind that any circuit changes made in an attempt to increase power output run the risk of increasing spurious emissions as well.

RIT

There have been many RIT mods published for various QRP rigs and it shouldn't be too difficult to adapt one to work with the Cub. However, there is limited room on the Cub's front panel for another pot and possibly a switch (perhaps one could use a pot with a center detent and eliminate the switch and). I would like to have RIT capability in my Cub, but I think that I will leave it to someone else to figure out how to do it and where to put the pot!

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Have you just purchased a new gadget, rig or kit that you would like to tell the QRP world about? Then write a review and send it to the QRP Quarterly! Reviews are handled by our Special Features Editor, Larry East, W1HUE (see page one for address). We have no strict guidelines for reviews, but we do ask that you include the manufacturer's basic technical specs and any results of technical tests that you have performed. If you are not sure about some aspects of the device that you are reviewing, don't guess; ask the manufacturer for clarification. (We reserve the right to also contact the manufacturer for additional details or clarification.) Please try to be as objective as possible: tell about the good as well as the bad features. Larry prefers to receive articles in machine-readable form as ASCII text files on PC format floppy disks or as email attachments.

If you want to send word processor files, Larry can handle MS Word 6/95/97, WordPerfect 5/6 and "Rich Text File" (RTF) formats (please don't do any fancy formatting or embed graphics within WP files). Figures (drawings and photographs) can be supplied as "hard copy" (good quality, B&W or color prints for photographs) or as digitized images (GIF, TIFF, JPEG, PhotoCD, PCX or bitmap files). If you want your disks, drawings, etc., returned, please enclose an SASE with sufficient postage.

From the ... Membership Chairman

Dale Halloway, K4EQ
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MEET MEMBER #10,000

Recently, the QRP Amateur Radio Club International passed a major milestone when it issued membership #10,000 to Parker Buckley, WD8JOL.

Parker is married to Carol and has a son Aaron, 12, and a stepson Adam, 16. His background is in aero engineering and thermo and is the Deputy Division Chief of the Propulsion and Advanced Concepts Division of the Propulsion Directorate at Wright Patterson Air Force Base.

Parker first became interested in ham radio as a youngster. His father was a Word War II radio operator who worked CW out of a half-track. He loved ham radio and Parker recalls his father taking him to visit a radio club in a nearby town as a youngster. After watching a couple of guys operating that night and seeing all those neat QSL cards on the wall, he was hooked. It took him a few more years to get his license, but, like most of us at some point in time, he was hooked forever. In 1977, while still in his twenties, Parker finally got his license. On March 12 of that year, he borrowed a Heathkit DX-40 transmitter from his father and promptly made his first contact. By the time he made his third QSO, he was using his very own Ameco AC-1, two-tube transmitter. Just the thought of those two classic transmitters gets the nostalgic juices flowing for many of us. Today Parker's station includes a NorCal NC-20, an Emtech NW-30, and a ZM-2 tuner. He recently got a Hallicrafters HT-32B on the air along with a SX-101A receiver. He especially enjoys CW and converted to a Vibroplex bug a few years ago. Parker's interest in QRP was sparked by his enjoyment of kit building and portable operation. You might find him portable from his back yard or at the beach on vacation. He enjoys working DX, especially while QRP, but also enjoys the longer, stateside QSOs. Last year while enjoying the sun on the Gulf of Mexico, he had bundles of fun working the VKs and JAs from the porch of a beach house. He was using battery power to his NC-20 and NW-30 with a dipole antenna. Now that's what I call having fun! Other interests for Parker are working on vintage equipment and constructing antennas.

In addition to QRP ARCI, he also belongs to ARRL, FISTS, and a local HF group that is just getting started. At the FDIM banquet in Dayton this year, Parker and his Carol were our special guests. To commemorate the occasion of QRP ARCI reaching the 10,000-member milestone, as well as to honor Parker, he was presented a certificate in front of the 200+ people present. Congratulations, Parker, on being QRP ARCI member number 10,000. We'll let you present the certificate to member number 20,000. . . .

Jim Stafford, W4QO and Parker Buckley, WD8IOL

Remember When . . .

Historical Notes

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WOW...Wasn't Dayton great this year! I sure had a great time and enjoyed talking to so many of my friends. Well this month we will be telling you about club presidents. This is a subject that President Jim Stafford inquired about on the QRP-L. The information presented here is as accurate as possible with the old Quarterly's available to me. An interesting note is that in the early days of QRP ARCI K6JSS was considered a general secretary and it was not until some years later that an elected president was in place. Early presidents were appointed, as were the officers. In many cases only a few people took on the running of the club. Help was hard to find and even harder to keep. We will start with Harry Blomquist K6JSS. Of course we all know that Harry started the original QRP club. It was shortly after the club started in 1961 that his health went down hill and he turned the club over to Ken Hughes W6CIS. In 1962 Ken was one of the original charter members and took control , of course Harry continued to help until his death. Number 3 on my list is Jim Perry W5NSE and his time was the 1965/1966 era. I have not had time to read all the details on this fellow but will post more later. In 1967 I read that the first elected President was Robert. Henrich W0GWT. He held a two-year term and was succeeded by Paul Smolarz WA2HYY. Paul was very much into the club business and spent time in many officerships. Notes indicate he was president until 1972 then there seems to be a void. I read that next we had Elliott Blaze W5TVW , his term ended in 1975. Not much info printed about this time and I read a whole QQ that did not even list who the officers were....Strange . We pick up again in 1975 thru 1979 with Hugh Aeiker WA8CNN. At this point the club went thru a restructuring and the QRP 5 watt club we all know came to be. Leading the club thru this era was Thom Davis K8IF. His presidency lasted till 1981 when Ed Popp K5BOT took over. I was Ed's VP for a while and then in 1986 I became president under my old call WB2IPX. My VP Jim Fitton W1FMR then became president from 1988/1989. Things are a little vague but I think Paula Franke WB9TBU was the next pres. She held it for two terms and then I took over as interm president until 1995 when Buck Switzer N8CQA took office. Buck is listed for several years also. 1997 show Mike Czuhajewski WA8MCQ as our leader followed by our present chief Jim Stafford W4QO.

Whew...what a history lesson. I wish I had time to extract info on each of these folks who served in a leadership post. Perhaps we will go into this again as I do my research.

72 Les,K4NK

Test Topics...and More

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Designed For Test - RF sensing cw monitor

In the last column I discussed a request from reader Hal Bergeson, W0MXY for a "wireless" cw monitor. Though I asked for others to suggest approaches there has been little feedback. But I won't let **that** stop me from responding!

I outlined a possible solution in the last column so let's look at an expanded description. What will be described is a "notional" circuit, that is one that should be close but has not been fully checked out. If you build it you may have to tweak it slightly to make it work exactly the way you want. This is how I often design things. I sketch out a circuit that I **think** will work then breadboard it so that I can get it just right.

Figure 1 shows the circuit. An RF detector senses the RF and produces a small DC voltage that is keyed at the CW rate. This is fed to the high impedance input of an FET switch to key it on and off. The FET then controls DC power to a simple tone oscillator.

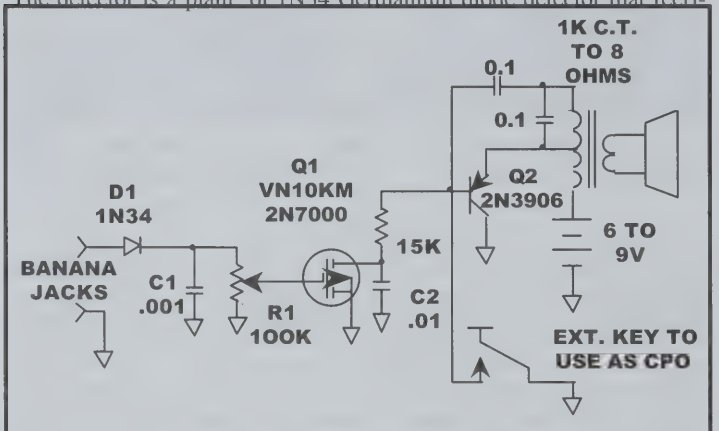

FIGURE 1 - WIRELESS CW MONITOR

The detector is a plain 'ol 1N34 Germanium diode detector that rectifies the RF input. Its DC output is filtered by a capacitor C1. This cap is big enough to remove any RF component but small enough to discharge the filter capacitor so that the detected DC follows CW keying. Potentiometer R1 provides this discharge function in addition to serving as a sensitivity adjustment for strong RF signals.

Q1 is an FET switch that can be switched to an "on" stage by about 1.5 Volts DC. A type VN10KM is best, but 2N7000 transistors can be selected for low turn-on. When it does turn on, its drain current provides bias to transistor Q2 enabling it to oscillate. This tone oscillator was described in "The Quickie Tone Oscillator" a Joe's Quickie that appeared in WA8MCQ's IX column in the July 1999 issue of QRP Quarterly. Connection for an external key is shown also so that you can manually key the oscillator for code practice.

The RF CW monitor needs no on-off switch since its power is turned on and off by a sensed CW signal. The down side of this is that you need a fairly large signal to do so, which is not always easy at QRP

Figure 2 uses a simple whip antenna. At QRP you may need to use a fairly long wire (5-10 feet) to pick up enough RF, especially when your transmit antenna is not close by.

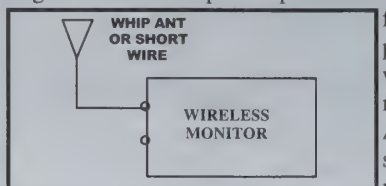

FIGURE 2 - SIMPLEST RF PICKUP METHOD

A QRPp rig may not produce a strong enough local field to activate the simple diode detector so other methods may be needed.

You can get more sensitivity and some selectivity by using a parallel tuned circuit as shown in Figure 3. Pickup can be by either the whip used above or by putting a "probe" inside an antenna tuner. The selectivity may be needed if you have nearby AM broadcast stations or a QRO neighbor. The inductor can be conveniently wound on a toroid core and the variable capacitor is a poly-dielectric variable than can be gotten from surplus outlets or from a scrapped transistor radio. Paralleling both sections of the capacitor gives a range of about 10 to 200+ pf. An inductor value of about 10.3 uH will tune from 80 thru 10 meters and 0.65 uH covers 20 thru 10 meters.

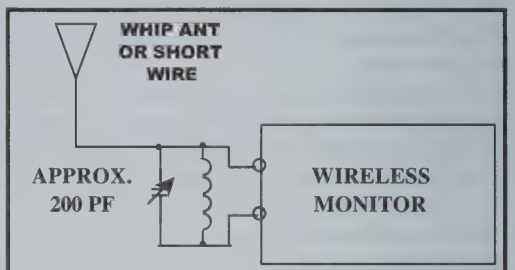

FIGURE 3 - TUNED CIRCUIT ADDS SENSITIVITY AND SELECTIVITY

If you want to couple more directly to your transmitter or tuner, you can add a link to the tuned circuit as shown in Figure 4. The link should be about 1/10 the number of turns used for L1. A single-turn link can be used to couple to an inductor in your transmitter's output filter network or to a coil in an antenna tuner.

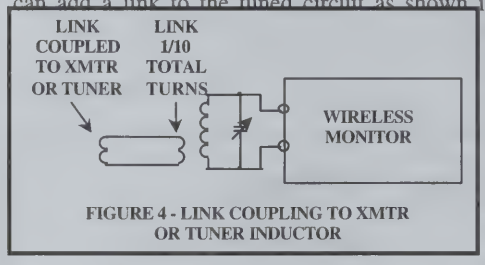

FIGURE 4 - LINK COUPLING TO XMTR OR TUNER INDUCTOR

Finally, you can directly couple to a coaxial antenna feedline if you are careful. This scheme may prove necessary if you are using very low power. It is not recommended for power levels above 10 watts or so since high RF voltages will be present. A "Tee" connector is used along with a modified coaxial connector signal sampler as shown in Figure 5.

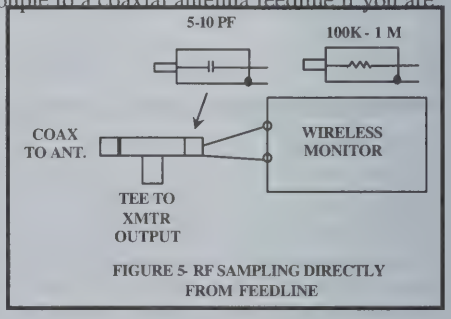

FIGURE 5- RF SAMPLING DIRECTLY FROM FEEDLINE

Connect the "tee" to your rig output and the antenna cable to one arm. The signal sampler goes to the other arm. The "sampler" uses a small capacitor or high-value resistor to pick off the RF sample.

Construction of the wireless monitor is non-critical. You can build it with point-to-point wiring, assemble on a piece of Perf-board or hop on the "Manhattan-style" construction bandwagon. I intend to build on using the latter method. Once I get it built and operational I'll try to

Coming To Terms

This column is mainly about "test" but there are a number of meanings to that word. As I pointed out in my first column it all boils down to "Stimulus and Response." You apply some stimulus to whatever you're testing and note the response.

In usual radio amateur usage, testing is rather informal. When we "test" something, it simply means a casual check to see if it works. For a receiver this might mean:

1. Does it receive signals?
2. Does it tune the ranges that it should?
3. Does it have good apparent sensitivity and selectivity?
4. Does it tune smoothly?
5.

And so on. This "seat of the pants" approach is what we usually do.

On the other hand the word "test" often has a more formal meaning. It is a well defined, usually written procedure that quantifies performance of a given piece of equipment. Most commercial ham gear and many well-designed construction projects have a list of specifications for, in the case of a receiver, sensitivity, selectivity, tuning range, signal to noise ratio, kHz per turn tuning rate, frequency accuracy, frequency stability dynamic range etc. This is more in line with commercial (and military) practice where products are bought and sold. Needless to say the formality is time consuming to do and usually requires special test equipment.

On the other hand, if you are striving for the very best performance, in-depth testing is important. For a good example of a formal test method check out the ARRL product review test procedure on the "member's only" site at *http://www.arrl.org/members-only/prodrev/testproc.pdf* to see probably more than you want to know!
A third type of testing can be either casual or formal. It is *comparative* testing. In it, you run a series of measurements on two similar pieces of equipment and note how each performs. Comparative tests are quite common such as when you try *your* rig at Field Day for a while then run someone else's to see how well it works. You really don't need to take data for comparative tests unless you are really serious about things. It's likely one of the most common types of test that hams run.

And More

Ok, I promised to describe how those handy antenna and SWR analyzers do their magic so here goes. The basics are really quite simple. The ones I'm familiar with, the Autek and MFJ units are pretty much the same at the lowest level. As shown in Figure 6, they consist of a tuned oscillator, a broadband bridge circuit, a "signal processor" and a display.

The real heart of these analyzers is a simple bridge. Consisting of only resistors it is inherently frequency-insensitive so it can cover a wide frequency range without special components or adjustments. The signal generator supplies an RF input that is split between the two legs. The left leg has two resistors while the right leg is made up of a fixed resistor and the "unknown" antenna or external impedance. For discussion purposes assume that all three resistors are 50 ohms. So if the antenna is also exactly 50 ohms the voltage at the middle of both right and left legs is half the input voltage. A detector connected across the middle of the halves would see the same voltage on each side or **zero** volts difference! This corresponds to a 1:1 SWR. When the antenna impedance is not exactly 50 ohms resistive, the bridge will be unbalanced and the amount of unbalance is directly proportional to the SWR (see the ARRL Antenna Book for the nitty-gritty details.)

OK, that's SWR, but how do they measure impedance? That's simple in concept, too. If you look at only the right hand leg of the bridge, you can see that the top resistor and the antenna form a voltage divider. When the antenna is zero ohms the voltage at the center of the divider relative to ground is zero and when the antenna has infinite impedance the center voltage is the same as at the top of the bridge. In between it exactly follows the voltage divider equation for a resistor (50 ohms) and a complex impedance (the antenna).

So far an important issue has been avoided – the tunable signal generator. It obviously has to tune across the whole operating range but for accurate readings it needs to maintain exactly the same voltage at the top of the bridge as it is tuned from highest to lowest frequency. This is usually achieved by having a third detector at the top of the bridge, which feeds an AGC signal back to the oscillator to maintain a constant voltage. This feedback mechanism also ensures that the bridge voltage is kept the same regardless of antenna impedance variations.

Signal processing runs the gamut from very simple to rather sophisticated. The earliest MFJ SWR Analyzers used an analog meter. For SWR display the meter sampled the rectified voltage across the middle of the bridge, which is proportional to the reflected power at the antenna port. Now it can be shown (whew that sounds professorial!) that SWR is proportional to the ratio of the forward and reverse power samples in a transmission line. Recall that the voltage across the whole bridge is maintained at a constant level this means that the bridge unbalance voltage is directly proportional to the **ratio** of forward and reverse samples. So the analog meter can be marked to read SWR directly (no deflection is 1:1 SWR, __% is 1.5:1, __% is 2:1, half scale is 3:1, etc.)

Similarly the antenna impedance can be displayed from the voltage that appears across the bridge right leg. As already noted the top 50 ohm resistor and antenna form a voltage divider. So the voltage at the junction of the two relative to ground is a function of the ratio of the two impedances. On a properly scaled analog meter, full-scale deflection occurs when the antenna is very large relative to 50 ohms, 2/3 scale is 100 ohms, mid-scale is exactly 50 ohms, 1/3 scale is 25 ohms and so on.

In the Autek analyzers and more recent MFJ units the detected samples are fed to an A/D converter and then to a microprocessor. This gives more computational power so that SWR and impedance can be output on a liquid crystal numeric display. Not only that, but the additional math power is used to accurately display the operating frequency and to compute effective inductance and capacitance of the displayed impedance as well as other more sophisticated parameters.

The analog meter is much easier to read when making antenna adjustments while the digital displays are capable of much better resolution (although not necessarily improved accuracy). You pays your money and makes your choice.

Stimulus and Response

I've received no formal requests for information since the last column appeared. However there were a couple of face-to-face requests for signal generator circuits. So the next couple of installments of the column will present a crystal-controlled signal generator and attenuator with calibrated outputs. Several fixed low-microvolt output levels will be selectable for receiver testing. And best of all, you will need only some very basic test equipment to get fairly accurate calibration.

Please write to me by either snail or e-mail to ask any test-related questions or to suggest some topics you'd like to have covered in a future column. **72/73, Joe E., N2CX**

FDIM 2000
SEIMINAR SPEAKERS . . .

L.B. Cebrik—The VOMBA Antenna

Rick Campbell—Developments in DC Receivers

Dave Benson—PSK31

George Dobbs—The Super Gainer Regen

Jim Kortge—the 2N22/6

Joe Everhart—Simple Antennas

Charles Moizeau—Wire Antennas

Mike Branca—GA Sierra Project

Ed Breneiser—QRP DXpeditions

The Solo II CW Sub-Woofer

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Introduction

A few years back (circa 1986), I made a resonant-horn CW speaker from a 7/8-in. mylar speaker and a 16-oz Solo cup and published it in Ham Radio Magazine as a "Weekender" project. The speaker resonated somewhere around 700 Hz, giving CW tones in that range a healthy boost. Although it provided a nice add-on for QRP radios with low audio output, it had a couple drawbacks. First, the tiny speaker wouldn't handle much power, making it vulnerable to damage. Second, 700 Hz was a little high in pitch for many seasoned CW operators.

The other day, while poking around my local RadioShack ™ store, I found a new part on the rack that caught my attention—a thin-profile 1-9/16-in. 16-Ohm Mini Speaker (RS273-093). This driver handles up to 350 mW and has a Fs (free-air resonance) of 480 Hz. Without hesitation, I grabbed it and headed for home with visions of a new Solo Cup speaker on Steroids forming in my brain. A couple hours and several dead cups later, the CW-Subwoofer was born .

Design

To work well, this type of speaker requires a small "peaky" driver—one with high Qts (resonance magnification) that will provide a strong response peak at its free-air resonant frequency (Fs). Also, the speaker's Fs should correspond with the desired CW pitch (480 Hz in this case). When this type of "acoustic engine" is loaded by a high-Q ported acoustic chamber tuned to the same frequency, you get a very efficient speaker with frequency response so narrow it also functions as a filter. An acoustical-response curve for the CW-Subwoofer is shown in **Fig. 1**.

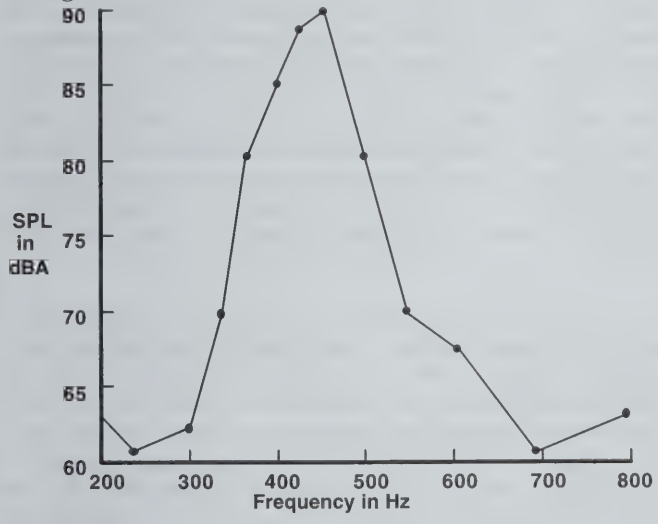

Figure 1. Frequency Response

Construction

All you need to build the CW-Subwoofer are a driver (RadioShack 273-093), a couple 16-oz Solo plastic beverage cups, some speaker wire, and a tube of strong plastic glue. Begin construction by cutting a 1.5-in. speaker hole in the bottom of one cup (I carved a rough opening with a sharp hobby knife, then finished it off with a small sanding drum). Next, glue the speaker onto the bottom of the cup. Now, take the second cup and, using sharp scissors, carefully cut a tuning port in it by removing a 1-in. x 5.25-in. strip around the rim (see **Fig. 2**). This should yield a 1-in. wide slot extending halfway around the circumference of the cup. If you plan to suspend your speaker by a string, drill a small hole in the base of cup #2 and install it before gluing the two cups together.

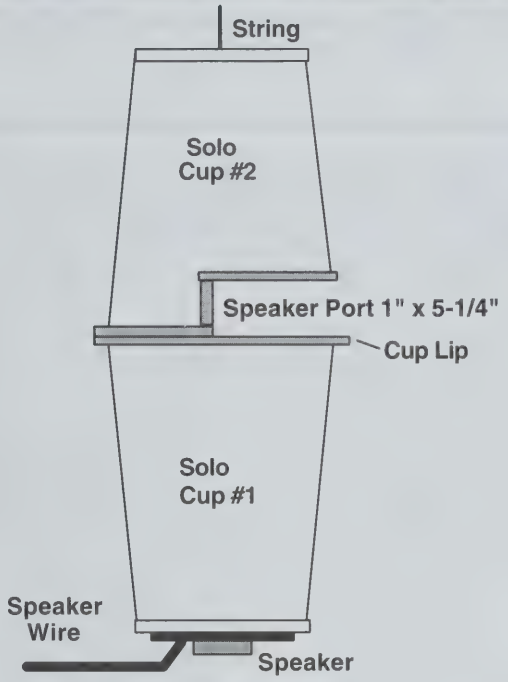

Figure 2. Speaker Construction Detail

To complete construction, glue the two cups together by the rims. If you're compulsive (like me), you may elect to trim the rim off the discarded section of cup and install it as "molding" to reinforce the bottom margin of the port. Attach speaker wire, and you're ready to rock-n-ro!l.

Performance

To check the frequency response of my speaker, I fed a tone from a HP-204C Audio Generator through a small amplifier with flat response, then measured acoustic output of the speaker at 3 feet with a Scott Instrument Laboratory model 451 weighted dBA sound-level meter. As the curve shows in **Fig. 1** shows, output peaked very close to the speaker's specified 480-Hz Fs point, then fell off by nearly 30-dB at 300 and 700 Hz respectively. A second weaker peak (not shown) also occurred just above 2-kHz. If your receiver has a reasonably narrow filter (1.5 kHz or less), you'll never know the second peak is there. However, if your radio uses a SSB filter or has a broad passband, you'll notice it.

The Solo Cup acoustic chamber becomes quite "live" when CW signals are tuned in, vibrating enough to scoot around on a smooth desktop. If you plan to set it on a shelf, install three or four stick-on rubber feet on the base to keep it stationary and rattle free (I suspend mine from a string like a bird feeder to avoid the problem). I also looped the speaker wire and taped it to the speaker magnet to protect against ripping the terminals off the speaker basket.

Conclusion

This may not be the most high-tech project you'll ever build, but it works great with little rigs like the 40-40 and MFJ Cub. It gives CW tones a "throaty" sound regular speakers simply can't deliver (kind of like installing a glass-pack muffler on your SUV). Give the CW-Subwoofer a try. It only takes a few minutes to build—and, if you don't like the way it performs, you can always use one of the leftover Solo Cups to down a few beers

QRV?

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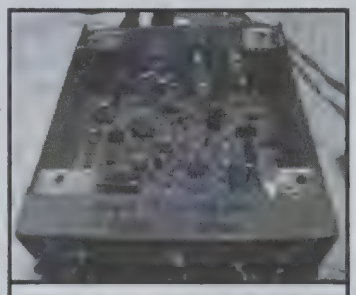
email: ko4wx@mindspring.com

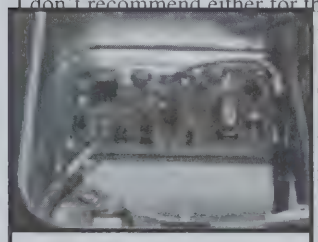
As I'm writing this month's column, I'm riding in the back seat of a BMW on the German Autobahn, cruising along at about 200 kilometers per hour. What's that got to do with QRP? Well, the "I" in ARCI reminds me that we are an *international* group, and that no matter where I go in the world, I've got my QRP friends. Although this business trip is way, way too short (I've been here two days and have to go home tomorrow), I have thoroughly enjoyed being here and the welcome that I have received. I look forward to coming back, meeting a few German ARCI members and maybe even operating as a /DL.

In the past month, I've had a blast, operating at QRPp (<1W power) in the "QRP To The Field," May "Spartan Sprint" and the Knightlights' "SMiTe Hunt." In these friendly contests, I used 2 different QRPp kit rigs, the Knightlights' SMiTe and the Norcal SMK-1, each running about 300mW. Both rigs use Surface Mount Technology (SMT), difficult, but incredibly fun, to build.



NORCAL SMK-1

I don't recommend either for the first time kit builder, but SMT is definitely within the capabilities of the reasonably experienced builder. For those of you that are just getting into construction, try a few other projects first, but don't be intimidated by SMT. All it really takes is a reasonably steady hand, a fine soldering iron, fine solder, a magnifying lens (with built-in light is helpful) and a lot of patience!



KNIGHTLIGHT SMiTe

At about 300mW, on 40 and 80 meters, I've worked 8 different states (GA, AL, SC, NC, KY, LA, and WI), and achieved 100 miles per watt several times. In the last column, I talked about the NOGAnaut transmitter, which will put out anywhere from about 30 mW up to about 220 mW or so (depending on the power supply voltage). My favorite was the 2xQRP QSO with Jim, N5IB, between Smyrna, GA, and Baton Rouge, LA, that resulted in 229 reports from both stations. At the time, I was running 13.8V into my SMiTe , and measured about 360mW out. There was a lot of noise and static on the band that night, and given that the QRN tends to increase on the lower bands in the summer months, it might be difficult making a DX QSO using the NOGAnaut, at least for the next few months.

Which brings me to the topic of this month's column—amplifiers. Amplifiers are at the core of just about everything we build in amateur radio. As I showed last time, even the basic oscillator is made using an amplifier. And as Doug DeMaw said, they are so easy to build that there's really no reason to build a transmitter with just an oscillator.

Bipolar transistors have the interesting property that when a small amount of current flows between the base and the emitter, a large amount of current flows between the collector and the emitter. The condition where a small amount of current flows between base and emitter is called *forward bias*. We can *amplify* a signal, by applying it to the base of the transistor. A small variation in the base current (that is, the bias, plus the *signal*) will cause a larger variable current to flow through the collector and emitter and through the load, causing a *gain* in the signal power (current times potential).

Most amplifier design is related to controlling the base-emitter and collector-emitter currents, by establishing the proper amount of forward bias. Remember from Ohm's Law that a certain potential (measured in Volts) will cause a certain current (measured in Amperes) to flow through a certain resistance (measured in Ohms). Ohm's Law becomes very important in establishing the forward bias of an amplifier.

The schematic shows a simple "class C" amplifier for the NOGAnaut transmitter. Initially, I built this circuit using the same 2N2222A transistor as I used in the original NOGAnaut. I tried several different transistors, but decided finally to use the 2N5109, which is a relative inexpensive transistor, generally available, and rated at up to 2.5 Watts output. Using this transistor, I managed to amplify my 220 mW NOGAnaut signal to 720mW, or about 10 dB (dB gain = 20*log (power1/power2)). Now that will really punch through the QRM!
Here's how the circuit works. The input impedance of transistor Q2 is about 10-12 Ohms. The output impedance of the NOGAnaut pi filter is about 50 Ohms. Merely connecting the output of the NOGAnaut to the input of the amplifier would be a very bad impedance mismatch, and would cause significant degradation of the signal as it flowed between the two circuits. The transformer is used to make a 4:1 impedance match between the two circuits. 50 Ohms divided by 4 is 12.5 Ohms, so this establishes a much better match. This transformer is described in many construction books, sometimes being a called a "transmission line transformer" because the twisted wire actually behaves like a transmission line (you can measure the characteristic impedance of twisted pair wire just like you can coax), significantly shortened electrically by the permeability of the toroid.

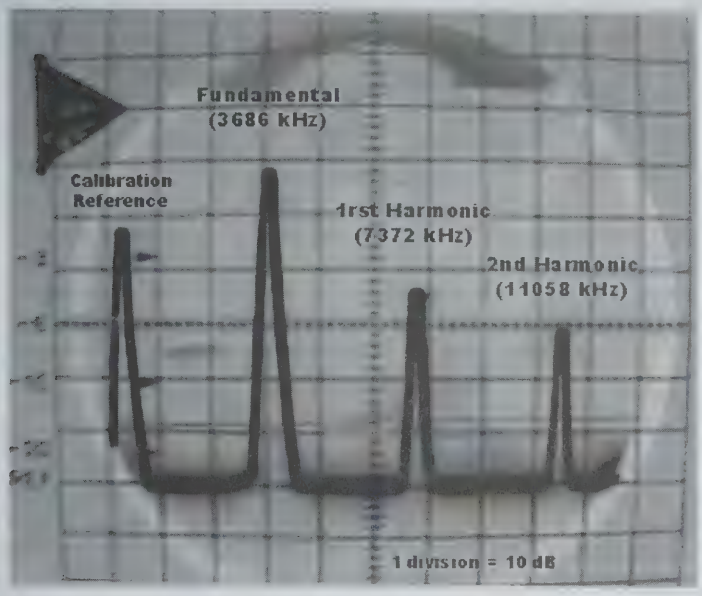
The 10 Ohm resistor helps to "tame the beast"—that is it lowers the "Q" of the transistor base circuit, and helps reduce the potential for feedback causing the amplifier to oscillate (see last column on oscillators). L3, C10 and C11 help prevent oscillations as well, shunting any RF coming in from the power supply to ground or choking it with the RFC (L3).

When a signal is applied to the base of Q2, through the matching transformer, it has a positive voltage, going from 0 to peak and back to 0, for half of the signal's cycle. This positive voltage causes a forward bias current to flow through the base-emitter resistance (there is a small resistance between base and emitter in every transistor), which in turn causes a larger current to flow between the collector and the emitter. Since this current must vary with the rise and fall of the bias, and since the current being supplied from the power supply doesn't change (there is a slight DC resistance from L3), the changing current must be supplied through capacitor C5.

The changing current through C5 appears at the output of the amplifier as a signal. It is important to note that this signal *is not* an exact replica of the input signal, since during part of the cycle, the input signal is negative and forward bias does not exist. This amplifier is not a *linear* amplifier. This means that it cannot be used for SSB and AM signals, because these signals would be distorted. For these cases, where the output signal must be an amplified replica of the input, a linear amplifier ("Class A" or "AB") must be used. However, Class C amplifiers work quite nicely for CW and FM signals, and can be extremely efficient.

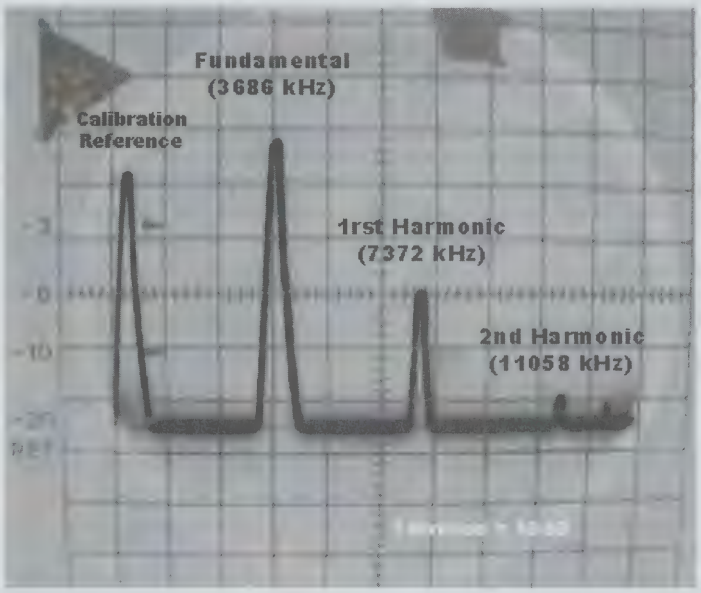
The filter formed by C7 through C9, L4 and L5 is very important in this circuit. They form two pi filter sections and are necessary to ensure

that the amplifier meets FCC "spectral purity" requirements. As I said in the last column, the simple pi filter in the NOGAnaut does not adequately attenuate its harmonics. Take a look at the next photo, taken of a spectrum analyzer looking at the output of the NOGAnaut with just the pi filter.



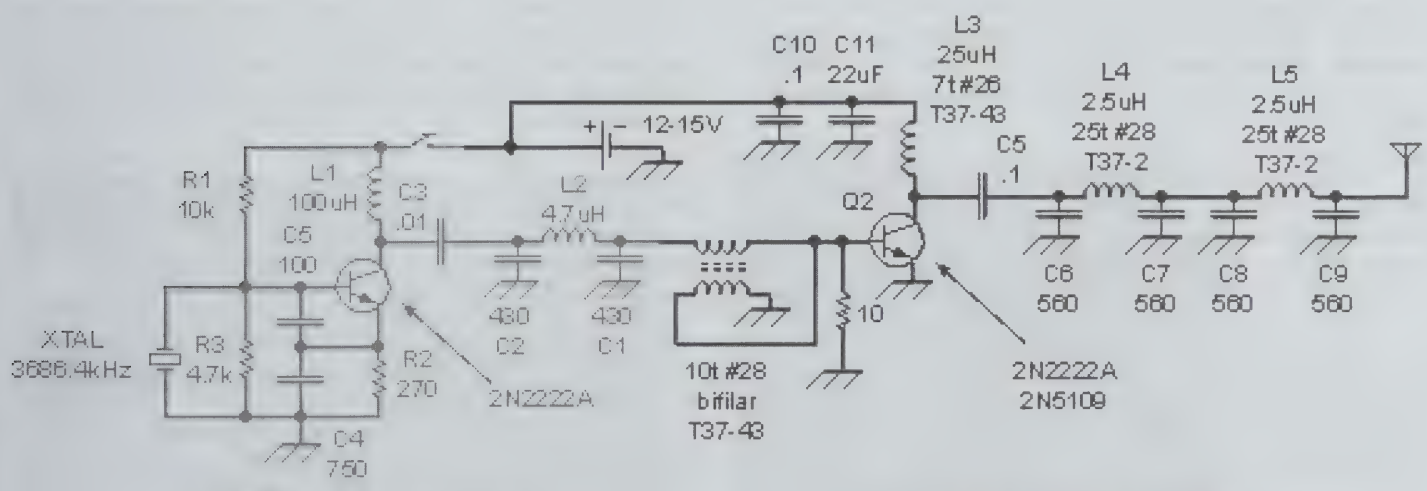
The spectrum analyzer effectively measures the level of the various components of the output signal. The horizontal axis represents frequency, increasing from left to right. The vertical axis represents signal strength, with a 10dB change per horizontal line. What this means is that the second harmonic is about 20dB lower than the fundamental. If your NOGAnaut is running at 200mW on 3686KHz, you're also transmitting a 20milliWatt signal on 7372KHz. Given that the 40M record is 452 miles at 221 *microWatts* (AA4XX-KA3WTF, 12/26/95), this could really be a problem! If this signal were amplified, you could be in real trouble (well, OK, your signal might not make that much difference against Radio Canada International at 7.3MHz, but *technically*, you are out of compliance with FCC regulations).

The NOGAboots Power Amplifier output filter is actually two pi filters, back-to-back. Notice that C6 and C7 could be replaced with a single 1120pF capacitor. Typically, this circuit is shown with a 1200pF capacitor (good enough, especially with 10% tolerance capacitors). In this circuit, I used two 560pF capacitors, because (1) they are easy to get and (2) it shows how the three-pole filter is actually just two half-wave pi filters. Now, however, the second harmonic is nearly 30dB down from the fundamental, as required by the FCC, and the third harmonic is nearly 50dB down! No more interference with Radio Canada International!



In the next issue, I'll talk about how transistors can be used as switches, and build a keying switch for the NOGAnaut (so that you can use your keyer with the transmitter). Finally, we'll put the transmitter into a case so that it looks nice, and then you'll be QRV—just in time for 80M to quiet back down for the winter.

72 de Mike, KO4WX



NOGAnaut Transmitter

NOGAboots Power Amplifier

REVIEW: MFJ 762 STEP ATTENUATOR

Mike Czuhajewski WA8MCQ *7945 Citadel Drive, Severn, MD 21144* *wa8mcq@erols.com*

Step attenuators are extremely useful things for any serious RF homebrewer, and quite a few articles could be written detailing their uses. Precision devices that give good performance to 1 GHz or higher are readily available from places like Alan, JFW, Hewlett Packard, Trilithic (formerly Texscan), Kay Elemetrics, and many others. Unfortunately they usually cost a few hundred dollars new, and most hams don't really need something that goes that high in frequency anyhow.

We've needed a good, low-cost step attenuator for hobbyist use for some time. When Jim Stafford first told me that MFJ added one to their product line and was donating one for a QRP prize at Dayton, I fired off an e-mail immediately asking him to send it to me first so I could play with it. And how'd I like it? Can't beat it for the price! The performance is much more than adequate for hobbyist use, and at only $69.95 it's eminently more affordable than the lab grade units. And perhaps best of all, unlike a lot of those high priced units, it looks like it would be very easy to repair if you damage it with too much power. (Accidents DO happen.)

Sure, you can sometimes buy used step attenuators at prices equal to or lower than the MFJ at hamfests, but that's usually as-is with no recourse if something is wrong, and always a gamble. But now we have a good, low priced unit available for the hobbyist market, and one that comes with an excellent one-year warranty.

The MFJ model 762 is a 50 ohm unit rated from DC to 170 MHz, and they say it's usable to 500 MHz. The basic range covers everything up to and a little beyond 2 meters, so it should meet the needs of all but the most demanding ham. The attenuation range is from 0 to 81 dB in 1 dB steps.

The size is listed as 6 ½ long X 2 ½ wide X 1 ½ inches deep. The BNC connectors stick out beyond that a little bit on the ends.

There are two different ways to make a step attenuator. One type, which the MFJ is not, has a single knob and steps of 1 or 10 dB per position. Typical units would cover 0 to 10 dB in 1 dB steps, or go from 0 dB in steps of 10 dB up to 50, 60, 70, or as much as 120 dB, depending on model. Some of them use rotary turrets which switch in 10 different sets of resistors, with a different set for each attenuation step.

Others use a smaller number of resistor sets, such as 1, 2, 3 and 6 dB. These are switched in and out by cams that activate microswitches on the appropriate sets as the knob is turned. With these 4 values, any number from 1 to 12 can be obtained by adding them together in different combinations. (This is a scheme used by HP, among others.)

The drawback to the knob type is that you need a pair of them to cover a large range, one with 1 dB steps, the other with 10, and a cable between them. All of that costs more and takes up more space. Some companies make dual units with two concentric dials on one package. They are equally expensive.

The MFJ 762 is typical of the other type of step attenuator that is also made by several companies. It also uses an additive method, but you add up the numbers yourself to determine the attenuation. It has switches for 1, 2, 3, 5, 10, 20, 20 and 20 dB. By selecting various combinations you can hit any value from 0 to 81 dB in 1 dB steps. (As with any step attenuator of this type, you do have to be careful when adding

The power rating is either 125 or 250 milliwatts, somewhat lower than most of the commercial units, which are typically rated at ½ or 1 watt. The manual makes it clear that you should not transmit into it, but hard-core milliwatting QRPers may do it anyhow. It's not a problem as long as you keep the power input to the unit under the rating.

The manual says 125 mW, or 1/8 watt, although the picture and text in their catalog say 250 mW. Either way, it's more than enough for most of the low level signal uses that hams would put it to. If you plan to use it at higher power levels, you could build some power attenuators with metal oxide resistors to knock down the power to a level that the 762 can handle. (See the Idea Exchange column in the January 2000 QRP Quarterly for some info on making your own.)

But if you do exceed the power rating accidentally and fry something, repair is quite simple. Just pop the cover and all of the resistors, which are surface mount units, are right there out in the open on the circuit board. (SMT resistors are cheap and readily available from places like DigiKey.) And if you accidentally apply too much power and wonder if you damaged anything—which might not always be obvious from a visual inspection--you can do a simple test with a low voltage power supply, voltmeter and 50 ohm load to check the attenuation of each section and see if any have shifted. (I described the method in the QRP Quarterly a few years ago.)

There are three different ways that attenuator sections can be constructed; one has the resistors in a PI configuration and the other has them in a T. A less useful form has them in an L. (Many references, such as Solid State Design and the ARRL Electronics Data Book, give data for the first two types.) For some reason, MFJ chose to use a mix of PI and T in this unit. The sections for 10 and 20 dB are T, while the lower values are PI.

Resistor values are given both on the schematic and in the parts list, although the schematic shows values for 5% resistors while the parts list gives 1% values. If you ever have to replace any of the resistors, use the 1% values. DigiKey has 1% SMT resistors from Panasonic; use the 1/8 watt 1206 size. The prices are higher than 5% but still quite reasonable, 98 cents vs. 84 cents for strips of 10 resistors (the smallest quantity they are sold in), and by sticking with the 1% values you get better accuracy.

Standard BNC connectors are used on the unit. However, many hams will probably be using attenuators in situations where UHF connectors are used. This requires use of a pair of BNC to female UHF adapters. MFJ includes a pair of them at no extra charge, which is a nice touch.

I did have one minor complaint about the unit; the action of the switches was rather mushy and the feel is not always positive. Sometimes I had to push a second time to make sure they latched in or out. The movement is pretty short too, making it sometimes difficult to tell at a glance if a particular switch is in or out (pushed in is the "on" position). Be sure to look carefully when adding up the numbers of the "ON" sections.

PERFORMANCE

Being a resistive unit, the MFJ 762 is rated all the way down to DC and thus it is usable at audio, low IF frequencies, etc. A lot of peo-

and fixed, use different technologies besides resistors and are frequency dependent. Their minimum frequency may be anywhere from HF into the GHz region. (K3TKS once loaned me one that was rated for a range of several hundred MHz in the region of 5 GHz!)

Some use movable ferrite vanes inserted into the signal path to introduce controlled loss, while some older signal generators that cover HF and above use piston attenuators. In those, moving a pickup loop closer to or farther from the input section controls the attenuation. There is nothing inherently wrong with either type, when used in the proper application. However, they do have a lower frequency limit that could limit their utility in some ham applications. (If you go shopping for attenuators at hamfests, watch out for this. A good rule of thumb to go by is to beware of anything that has an infinitely variable dial rather than going in discrete steps.) The MFJ, though, works down to DC so it doesn't have this limitation.

When you insert any step attenuator into a circuit and set it to 0 dB, there will be some small amount of loss, which is called the "insertion loss." The manual calls it "bypass loss" and lists it as <0.65 dB at 170 MHz. The unit I tested was slightly over that, at 0.71 dB, but well under at other frequencies: 0.08 at 1.8 MHz, 0.19 at 30 MHz, 0.28 at 50 MHz and 0.60 at 144 MHz.

MHz---	1.8	30	50	144	170 MHz
1 dB	1.00	1.00	0.99	0.96	0.94
2	1.96	1.96	1.96	1.94	1.91
3	3.00	2.99	2.99	2.98	2.95
5	4.91	4.90	4.90	4.91	4.87
10	10.05	10.06	10.05	10.11	10.03
20 left	19.89	19.85	19.82	19.59	19.44
20 center	19.76	19.73	19.70	19.45	19.34
20 right	19.85	19.80	19.77	19.50	19.40
Insert.	0.08	0.19	0.28	0.60	0.71

The attenuation accuracy is specified as plus or minus 0.2 dB or 5% of total attenuation, whichever is greater. The sections of 10 dB and lower were well within the 0.2 dB limit. All three 20 dB sections went beyond that, but were well within the 5% limit. The table shows the values I measured for each section at various frequencies. (These values are all referenced to the 0 dB position of the attenuator.)

As is the case with any attenuator that is characterized at a number of discrete points over a wide frequency range, you have to take the table with a grain of salt. While you know how it performs at those frequencies, you cannot assume that the response goes in a perfectly straight line between any two points, or even that it goes in the same direction all the time.

For instance, the 20 dB section on the right was measured at 19.80 dB at 30 MHz and 19.40 at 170 MHz. You cannot mark those points on a piece of graph paper, draw a straight line between them, and use that to determine the response at any given point along the way with tremendous precision, although it would give a good ballpark indication. There could well be high and low ripples along the way, which become more evident as you decrease the number of dB per division on the screen, and some of those could even be outside of the range of 19.40 to 19.80 dB. You'll see that even in those high priced attenuators, especially as they age. However, the table does give a good overall picture of the performance at several frequencies of interest, and the MFJ compares favorably with a lot of those high priced units.

The numbers above were obtained with an HP 8753C vector/scalar network analyzer, a very useful, highly versatile and extremely expensive RF instrument. I didn't bother looking at the response above the rated upper limit of 170 MHz due to limited time available. MFJ says that it is "usable" to 500 MHz. The attenuation will deviate more and more from the nominal value as the frequency is increased, but you would still be able to get useful information from it. The manual includes two graphs showing the frequency response of a typical unit set for 0 dB ("switches out") and 9 dB, plotted against frequency. (The lines labeled A in their graph show the frequency response and the lines labeled B show the return loss.) Although they say it is usable to 500 MHz, the graphs go to 700 MHz.

SUMMARY

This is a very handy, well performing, reasonably priced little unit that has been needed for some time in the hobbyist market. Step attenuators are extremely useful devices, and this should be a very popular addition to the MFJ line. If I didn't already have a houseful of those "high priced" attenuators (all picked up used, of course), I'd get one of these in a heartbeat.

Manufacturer information: The MFJ 762 50 ohm step attenuator is made by MFJ Enterprises, Inc; P O Box 494; Mississippi State, MS 39762. For orders, call 1-800-647-1800. You can also check their web page at www.mfjenterprises.com.

--qrp--

Napping? QRP ARCI President Jim Stafford, W4QO "working" the FDIM seminar sign-ups

Ron Gibbs, 8P6BS

Reusing the Wall Wart

by Phil Karras, KE3FL *email: ke3fl@arrl.net*

What is a "wall wart?" I'm sure you have a number of these things around; I sure do. These are those little (or not so little) black (but sometimes white) cubes with AC power connector blades on one face. You plug it into the wall and it converts the AC voltage to DC voltage at some specified current. Once you plug it into the AC outlet it sits there like a black (or white) wart on your wall, thus the term of endearment, "wall wart."

If you're like me, you simply can't throw these things away if they still work, even when the item they powered is long gone. I have all sorts of wall warts (WWs), from 6 volts to 15 volts, and with different current ratings.

There are a few things you need to know if you want to reuse a WW to power a different device; they are:

1. You have to have the right power plug to fit the new device.

2. The plug *must* be wired correctly; this is called the right "polarity." Your new device won't last very long if you apply positive voltage to the negative connection. Most devices are still center positive but more and more are center negative. (I hate center negative. It puts the positive voltage on that long outer barrel and cars are usually chassis negative, what a good way to short things out in the car!)

3. You need to supply the correct voltage with no more than +10% at the lowest current the device uses.

4. You need to make sure there is sufficient current.

While we all know that the first two are very important, some may not understand the importance of the last two taken together when using a WW. This is because we've been taught that if a supply has the correct voltage and a higher-than-needed current rating (like a battery) everything will be fine. After all, the device only takes as much current as it needs. The power supply does not "force feed" the device with more current than it should.

For a regulated constant voltage power supply, this attitude is just fine, but for the unregulated fluctuating voltage WW, it is not. The two numbers given on the WW *must* be taker graph will help here.

Figure 1 shows the Voltage vs Current graph for a 12 Volt, 300 ma wall wart. This is the kind I've used for my Trickle Charger Plus.

We can see that the lower the current draw from the WW, the higher the voltage. On this system if we take only 10% of the rated current, we get a voltage of about 15 volts, which is 25% higher than needed!

The form of the equation for this curve is: **Y=a[0]+(a[1]+(a[2]*X)*X** where:

a[0] = 1.620780E+001
a[1] = -1.641596E-002
a[2] = 8.581617E-006

Or the equation can be written as: **Y=16.21 - .01642*X + 8.582E-6*X^2**

NOTE: *I've used four digits in the equation but my measurements used 3 digits at times. Thus, the final answer must be limited to three digits.*

As a design example, let's assume you have a radio that needs 12 Volts at up to 400 ma. We have tested the radio and it works just fine all the way down to 9.5 volts. The lowest current the radio uses (radio on but volume all the way down) is 200 ma. We have a WW rated at 12 V 300 ma and we want to know if this WW will be able to power our new radio. At 200 ma, our WW will be up to a voltage of about 12.9. This is below the 13.2 +10% voltage so that looks OK. Now at 400 ma, the voltage will be around 11.0, which is well within the operating limits of the radio, so it looks like this WW will be OK for the new radio.

You see we first measured the current requirement for the new radio and then found a WW that supplied the needed current at the needed voltage with no more than about +10% excess voltage and it still had an acceptable low voltage for full current use as well.

Another way is to get a WW that exceeds the needed voltage and current. The voltage in this case should be at least 2 volts above the voltage needed, with current rating above that needed as well. We now use a voltage regulator - either the 78xx series or the LM317 variety. Make sure you use a regulator that can supply 50 to 100% more current than the needed device and that you heat sink it properly. I did something like this for my new/used HF receiver. I built into the receiver the 9-volt regulator and then supplied it with 12 volts from a battery being trickle charged through the external power port. This way, if the power fails the battery takes over.

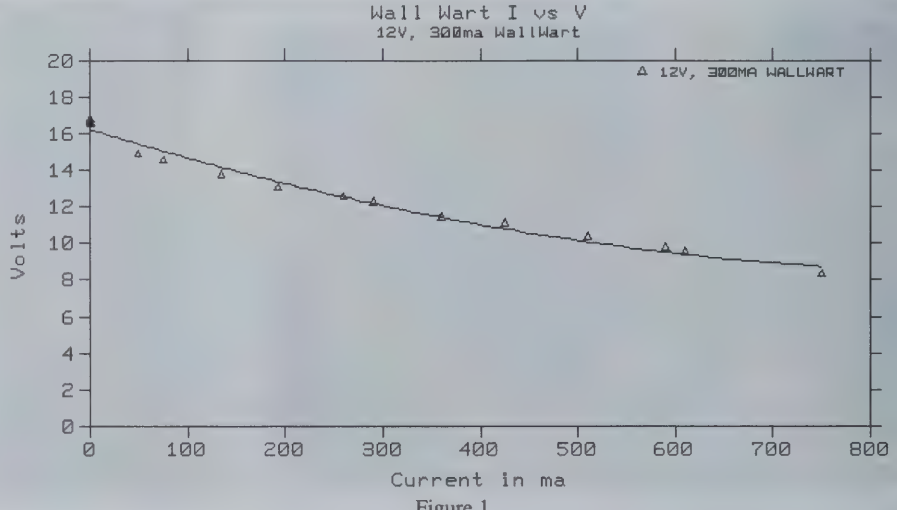


Figure 1

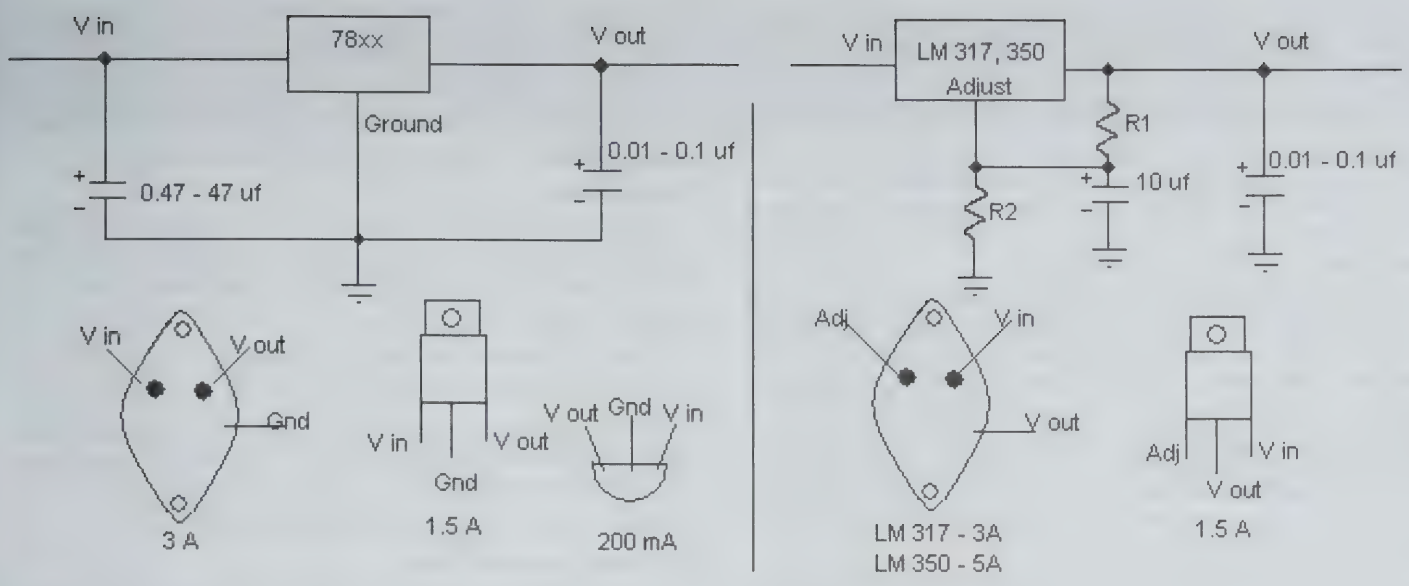


Figure 2

Figure 2 shows typical circuits. You can use either a small 7809 to power a small device that normally uses a 9V battery, or a LM317 to make a 13.8 V 2A supply for a typical HT. For the 9V version, you can use the lower capacitance values; for the LM317 or LM350 use the larger values:

NOTE: *R2 for the LM317/350 can be a variable resistor, which makes it a variable Vout.*

The LM 317 can supply up to 1.5 amps, the 350 up to three. The equation for the resistor divider for the LM 317, 350 is: Vout = 1.25 (1+R2/R1) + (Iadj)(R2). Since Iadj is about 50 uA this term can be left off. There will be some slight increase in Vout with insufficient load.

I hope this helps you understand what you can and cannot (or should not) do with a WW as it comes. These are wonderful little devices, but we must know how to use them properly or we can destroy the battery or device we're trying to use.

I've used them for my "Trickle Charger Plus" to keep Gel Cells, NiCds, and Lead Acid batteries topped off and "Emergency Ready" for years. I've also used them as they come, to power CD players, radios, and tape players. Last, I've used the regulated versions to power Game-Boys, CB radios, and 2-meter HT's.

73 de KE3FL
Phil Karras

(Edited by N4XY)

(Technical Editor's comment: The 10% over-voltage "rule" should be considered a *quide*, not a rule. There are many circumstances where a 10% over-voltage would be unacceptably higher than a manufacturer's rating.)

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Technical Review: The MFJ Cub Transceiver

Russ Carpenter, AA7QU 47227 Goodpasture Rd., Vida, OR 97488 email: russ@natworld.com

This is a summary of an in-depth review of the MFJ Cub that appeared in the May 2000 issue of the Adventure Radio Society's on-line magazine, ***The ARS Sojourner*** *(http://www.natworld.com/ars/). See the complete review for details on measurement procedures and comparisons with other HF transceivers.*

This is an interesting review. Our sample radio (a 15-meter version) was kindly lent to us by Larry East, W1HUE. Larry's Cub contains several modifications (see his article in this issue of ***The QRP Quarterly***). Larry provided us with a complete list of his modifications. Only one of them would affect a test we would otherwise make—frequency stability. Many owners of the MFJ Cub have reported problems with VFO stability, and Larry reports that his modification significantly improved the radio. We decided not to test Larry's radio for stability and to let the material Larry has published on the topic speak for itself.

A reasonably complete set of specifications for the Cub appears on MFJ's web site, http://www.mfjenterprises.com/index.htm, and we won't repeat them here.

Transmitter Tests

Power Output

Rated output for the 15 meter Cub is 1.0 watts. Our sample produced a maximum output of 1.1 watts with a 13.8-volt power supply and 1.0 watts with a 12-volt power supply.

Power Requirements on Transmit

With a 13.8-volt power supply, our Cub drew 255 mA with 1.1 watts of RF output. With a 12-volt power supply, our Cub drew 255 mA with 1.0 watts of RF output.

Spectral Purity

FCC regulations require the spurious emissions from a 1-watt radio to be at least 30 dB below the carrier. In our sample, the second harmonic was 38 dB below the carrier, and it therefore met the FCC's requirement. MFJ's specifications state that spurious emissions will be 40 dB below the carrier. The spectral purity graph for our sample is shown below in **Fig. 1**.

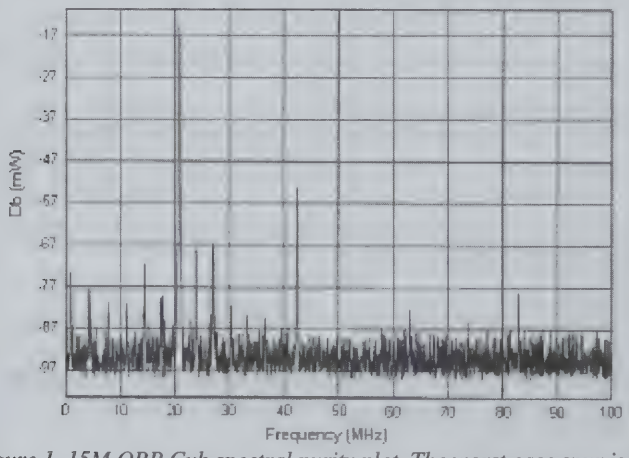

Figure 1. 15M QRP Cub spectral purity plot. The worst-case spur is the second harmonic (at 42 MHz) and is 38 dB below the carrier.

Introduction to Receiver Tests

Many of our receiver test reports use bar charts that compare the unit being reviewed to a number of other HF transceivers. The charts are not included here but can be found on the ARS web site along with a brief explanation of the purpose and layout of the charts.

Receiver Tests—When No External Signals are Present

Tuning Range

The tuning range for our sample was 21.020 to 21.062 MHz. W1HUE has commented that he had set the range at 21.024 - 21.066. The VFO slug probably changed position slightly during shipping.

Spurious signals

There were no receiver birdies in our sample.

Power Requirements on Receive

Our sample drew 39 mA on receive with a 13.8 volt power supply, and 37 mA with a 12 volt power supply. MFJ specifies 36 mA on any 12 to 15 volt power supply.

Receiver Tests—When One External Signal is Present

Minimum Discernible Signal

On 21 MHz we measured an MDS of -126 dBm. We independently measured a noise figure of 16.3 dB, using a calibrated noise source. (This noise figure does not correlate as well with MDS as it usually does. This was probably caused by the poor shape factor of the Cub's crystal filter, which interfered with our assumption about the radio's noise bandwidth.)

A noise figure of 16.3 dB on 15 meters might be regarded as adequate for casual operating. In general, the literature seems to agrees that a 15 meter receiver should have an RF preamp (which is lacking in the Cub), and that its noise figure should be 12 dB or better.

Phase Noise

The Cub's phase noise was disappointing when compared to other non-synthesized radios. We measured phase noise of -124 dBc/Hz at a spacing of 10 kH from the carrier. However, this is still within our "good" rating range.

IF Rejection

Our sample's IF rejection was 74 dB. This is a little weak when compared to similar radios which typically have IF rejections in the range 78-80 dB.

Image Rejection

Our sample showed a middle-of-the-road image rejection of 64 dB.

Audio Output

Our Cub had very good audio performance. At full volume, total harmonic distortion was only 1.0 percent.

Receiver Tests—When Multiple Signals are Present

Selectivity

We measured a 6 dB IF and AF response of 740 Hz, as compared to the specified nominal bandwidth of 750 Hz. You will find interesting information about the width and shape of the Cub's IF and RF response in this AF spectrum analyzer graph (see **Fig. 2**). In comparison to other similar radios, the Cub's shape factor was not impressive.

Blocking Dynamic Range

Our Cub had a blocking dynamic range of 106 dB, which is about average for radios of this type.

Third Order IMD Dynamic Range

The Cub's third order dynamic range of 79 dB is at the low end of the range for similar radios.

Third Order IMD Intercept Point

We calculated a third order intercept point for our Cub of -7.5 dBm, which was a little better than average among similar radios.

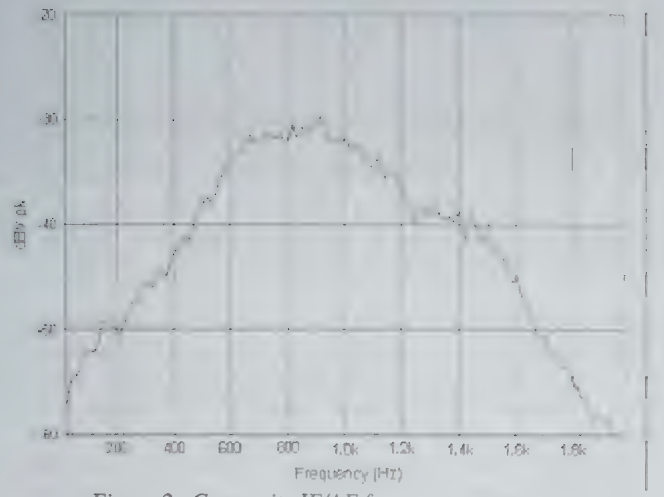

Figure 2. Composite IF/AF frequency response.

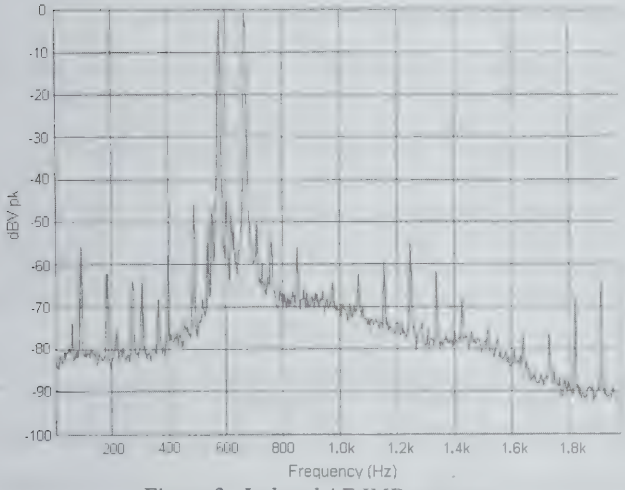

Figure 3. In-band AF IMD response.

Second Order IMD Dynamic Range

Our sample had a respectable second order dynamic range of 94 dB.

Second Order IMD Intercept Point

We calculated a second order IMD intercept point of 62 dBm, putting the Cub in the middle of the pack of all radios for which we have data.

In-band IMD

The Cub's in-band IMD performance was excellent, which is another indication that the Cub's audio circuitry performs very well (see **Fig 3**).

Conclusion

The MFJ Cub has turned out to be a "happening," as well as a radio. The ARCI has organized a group purchasing program for the Cub, and in turn the Cub has been the focal point for an outstanding educational program.

The Cub is easy to build. This feature, and the ARCI's support, has probably attracted a number of newcomers to the QRP community. We vigorously support anything that draws new participation into this magic hobby of ours.

On the other hand, experienced low power operators might have some reservations about the Cub. In terms of its technology, it might be described as a "me too" radio. Designs based on the NE602 (and its successors) and the LM386 have been around for a long time. The Cub has a herd of competitors (from such companies as Wilderness Radio and Small Wonders Labs), and some of the competing radios might be better performers.

Keep in mind that our sample Cub was the 15-meter version, and there are no similar single-band kits currently available for 15M with which we can make direct comparisons. It is possible that the issues we encountered with sensitivity and selectivity may not be present in lower frequency models of the Cub. Apparently, however, the Cub's problems with VFO drift are pervasive, affecting all of its models at least to some extent.

Edited by W1HUE

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1000-MILES-PER-WATT
ON ALL HF AMATEUR BANDS

by Wayne M. Sutherland, NQ7Q

1000-Miles-Per-Watt is a nice award put out by the QRP Amateur Radio Club International, and a decent goal for anyone interested in operating QRP. My local ham buddies (also mutual sources of ideas, protagonists, and antagonists as appropriate) N7JT Jerry and AF7E Bill both have had their 1000-Miles-Per-Watt certificates on the walls of their shacks for a number of years. In emulation of their efforts, I decided that I could (and should) also achieve 1000-miles-per-watt, and acquire that wallpaper for my shack.

Before attacking that goal, the advice of others was taken into account: You can do it on 10m easily when the band is open; the lower bands probably can be done only on CW; 160m would be awfully tough; etc. At about the same time, AF7E Bill and I were goading each other into starting out on a 160m QRP WAS endeavor. Bill got a jump start on it, and we both began one contest evening running less than 5 watts output SSB on 160m. He stayed up a bit later than I did, and still has the lead over my 27 states confirmed QRP SSB on that band, and he only needs a card from North Dakota for QRP WAS using several bands.

I became sidetracked with other projects, and have a long ways to go for QRP WAS. I did, however, get fascinated with the possibility of 1000-Miles-Per-Watt on 160m during the winter of 1998-1999. I didn't know if any group offered an award for 160m, but a personally designed challenge often is more satisfying than one already laid out for you. Most of my efforts centered on contests, since there are a lot of stations to choose from, and the good contesters usually have good ears. My first attempt at 1000-miles-per-watt on 160m involved answering the CW "CQ TEST" of several different stations in Hawaii during the ARRL 160m and CQ 160m CW contests. From my QTH in Laramie, WY to Hawaii is about 3300 miles; so I made sure my indicated power out never exceeded 3 watts. I almost made my goal, but the one station that could copy my weak "NQ7_" could not be certain of the last letter "Q".

My Diawa CN-720B meter has a large, easy to read dial, and seems to be accurate reading power-out in the range of .5 to 10 watts when compared with several other meters of various types. Just to be sure, I kept my meter reading noticeably less than 3 watts on CW, and less than about 2 watts on the highest voice peaks when I operated SSB on 160m. I tested the meter for voice peak readings prior to my transmissions to make sure that loud (excited) speech accents would not exceed my predetermined output limit, allowing for the needle to lag below the actual peak.

During the CQ WW 160m SSB contest, I got lucky. On Sunday morning, Feb.27, 1999, at 1335 UTC, just as it was getting light at my QTH, KH7R Ken pulled my less than 3 watt SSB signal out on my third call, just like any other station he was working. I guess QRP SSB does work on the Top Band. Was it my super antenna? No. I used a full-wave-sorta-distorted, tilted wire loop peaking at about 55 feet on my 60 foot tower, with the low side about 10 feet above the ground. Most likely, the band was just nice and quiet in Hawaii.

After that experience, and with a bit of needling from AF7E Bill, I decided to go for 1000-Miles-Per-Watt on all HF bands. No special award that I knew of, but a nice personal goal. I worked several stations around the world using only 1 or 2 watts on various bands, and then waited for QSL replies to my SASE's. The lower bands required the most planning, but I worked AH6OZ Walter in Hawaii with less the same day, also with less than 3 watts SSB on 40m. Antennas were home-built wire delta loops in the vertical plane, with the 80m loop being a bit squashed at only about 36 feet.

CF1GO Jerry on Random Island, Newfoundland, Canada responded to 1 watt SSB on 20m. I had a nice 17m chat with ZL4JP George in Gore, New Zealand using 1.5 watt SSB through my Mosley TA53M at 60 feet. I worked T33RD on Banaba Island 15m SSB split in a 10KHz wide pileup using less than 1 watt, and got him on the first call (I listened carefully to the pileup, and looked for an opening before calling). JA7JH Hikita in Japan chatted with me on 12m SSB while I was putting out less than 1 watt. On 10m SSB, less than 1 watt also allowed me to chat with VK3CB Clifford in Dereel, Australia.

Due to work related activities and other commitments, I didn't finish up with 30m 1000-Mile-Per-Watt until my schedule with AF7E Bill on his Dec., 1999 trip to Iowa. I was to call him, and I kept the power low, figuring on increasing it slowly until I had exceeded the guessed maximum allowed for 1000-Miles-Per-Watt. At that point I would QRO to about 60 watts. He came back on my first 0.25 watt call, but he could not copy the signal report due to local noise. I increased the power to 0.6 watt; he copied my signal report, and gave me a 229. The last one I needed to achieve my goal of 1000-Miles-Per-Watt on all Amateur HF bands!

Summary of NQ7Q 1000-mile-watt QSO's:

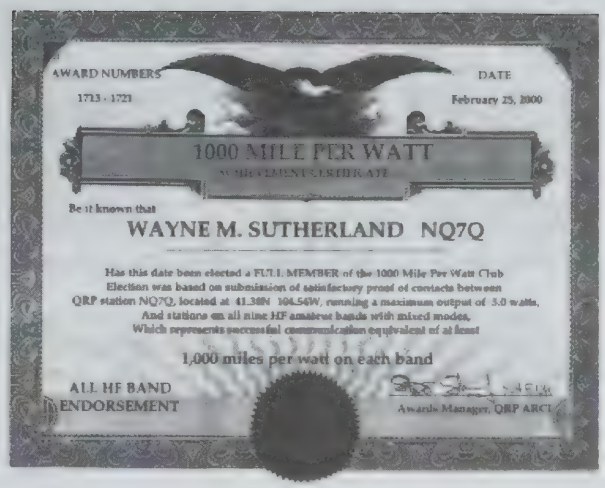
Band	Mode	Power Watts	Station Worked	Location City, Country	Distance Miles	Miles/Watt
160m	SSB	<3.0	KH7R	Honolulu, HI	3329	1109
80m	SSB	<3.0	AH6OZ	Kailua, HI	3320	1106
40m	SSB	<3.0	JH4UYB	Hiroshima, Japan	6054	2018
30m	CW	0.6	AF7E	Blairstown, IA, USA	696	1160
20m	SSB	1.0	CF1GO	Random Is, NF, Canada	2543	2543
17m	SSB	1.5	ZL4JP	Gore, New Zealand	7990	5326
15m	SSB	<1.0	T33RD	Banaba Island	5991	5991
12m	SSB	<1.0	JA7JH	Fukushima, Japan	5389	5389
10m	SSB	<1.0	VK3CB	Deereel, Australia	8836	8836

How did I figure the locations and distances? For three of the stations, I lucked out, and their latitudes and longitudes were listed as additional information under their call signs in the QRZ database. The other stations required the use of a good world atlas, and some measuring devices. I measured between latitude and longitude grid lines to figure the coordinates as close as possible for each (remembering 60 min./degree, and 60 sec./min.). Once I had their locations (some GPS units require either decimal minutes or decimal degrees), I entered them as waypoints into a GPS unit to determine the distance between my station and theirs. The calculations can be done manually, but they are very time consuming, and at the present, I would rather use my available time for operating, rather than calculating (and learning how to). After filling out 9 applications for the 1000-Mile-Per-Watt award, and sending them in to the QRP ARCI Awards Manager, N4EUK Steve, he

to show that it represented all 9 HF bands, and I would only have to pay for one certificate! Not only that, his records did not show that anyone else had applied for 1000-Miles-Per-Watt for all HF bands....he thought this was a first!

So what is my next QRP challenge? I'm still working on QRP WAS, but the amazing conditions during the ARRL International DX Contest on March 4 & 5 netted me 64 QRP DXCC Countries! Side- tracked again, maybe I can work past the 100 mark this spring while propagation is hopping! Hopefully that will be mixed in with trying to finish up my QRP WAS.

73, de NQ7Q Wayne


AWARD NUMBERS
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DATE
February 25, 2000
1000 MILE PER WATT
Be it known that
WAYNE M. SUTHERLAND NQ7Q
Has this date been elected a FULL MEMBER of the 1000 Mile Per Watt Club
Election was based on submission of satisfactory proof of contacts between
QRP station NQ7Q, located at 41.38N 104.56W, running a maximum output of 5.0 watts,
And stations on all nine HF amateur bands with mixed modes,
Which represents successful communication equivalent of at least
1,000 miles per watt on each band
ALL HF BAND
ENDORSEMENT
Awards Manager, QRP ARCI

AWARDS

Steve Slavsky, N4EUK
12405 Kings Lake Drive
Reston, VA 20191
email: radioham@home.com

Again, please note my e-mail address is: radioham@home.com.

If for some reason that one is down, try restonham@yahoo.com. My old address @erols.com, which is in previous issues of the Quarterly, is now gone. If you have e-mailed me at the old address and didn't receive a response, that's because I never got your message. Please send it to me again.

Additionally, some award applicants are sending their paperwork to award managers of many years past. When these past managers are kind enough to forward your mail to me, I am able to issue your awards. Sometimes, however, I'm sure things fall through the crack or they may have even moved. The best place to verify the current name and address of the QRP ARCI Awards Manager, and, in fact, all ARCI officials, is at our homepage: http://www.qrparci.org - that way you will have the most up-to-date information.

I finally cleared out the awards backlog in mid-May and everyone who applied for an award before May 10, 2000 should have received it long before this issue hits the streets. I apologize for taking a little more time than anticipated in issuing some of them, but the volume has been fairly heavy and I was unable to get to them as quickly as I wanted.

I am using a new tool for calculating miles per watt that you can use easily for the same purpose. First, if you don't know your exact longitude and latitude, and that of the station you worked, you need to go to one of the callbooks on line and get that information. I suggest either Buckmaster at http://www.buck.com/cgi-bin/do_hamcall or QRZ at http://www.qrz.com/ . Both provide latitude and longitude or at least a grid square for the vast majority of US and foreign hams. Next step is the fun one – go to http://www.qsl.net/n9ssa/mpwcalc.html - this site is courtesy of N9SSA, Pete, and is the fastest and easiest way to perform your calculations. Plug in the appropriate information, hit the calculate distance button and you have instant results. That's a lot easier than using a hand calculator. I believe you can actually download the program to your desktop, though I have not done that. Pete may be contacted at n9ssa@arrl.net if you have any questions about his calculator. Thanks, Pete, for making this tool available to us.

As we reach the sunspot maximum for this solar cycle, you should take advantage of the high sunspot numbers and go for awards on 10 and 6 meters. I am getting more applications than in the past for 10, but virtually none for 6. With all the contests, Field Day and other on-air opportunities, you can complete WAC, WAS and maybe even DXCC in record time. 1000 miles per watt on 10 meters is so easy you can achieve it on almost any afternoon. I am running one of the new Radio Shack HTX-10s in my car with a converted CB antenna and I can talk to Eastern Europe, Africa and South America easily (from the East coast) at the 5 watt setting.

I hope your summer is enjoyable and that you have many happy hours operating QRP, from home, your car, or portable on vacation. Remember, verification for the 1000 mile per watt award doesn't need to be a QSL card, which can take a very long time to receive. We accept e-qsls, e-mails, letters, and any other form of verification from the station you worked which includes contact data. Happy QRPing.

. . . Steve, N4EUK

QRP Clubhouse

by Doc Lindsey
PO Box 6028
Bismark, ND 58506
email: k0evz@arrl.net

NOVA-QRP Club is the high-powered, low power group in Northern Virginia. Founded in 1999, NOVA-QRP is modeled after NorCal, with no officers, by!aws, rules, business, or much of anything. But it has already grown to list nearly 50 QRP hams on its Internet mailing list, and attendance at the bi-monthly gatherings is around 25. Meetings are held on the second Saturday of odd-numbered months (January, March, May, etc.) at Mama's Italian Restaurant at Fairfax Circle in the City of Fairfax. There are no published start and end times for the get-togethers, but those in attendance usually have lunch, which should be a clue. A prominent feature of the meetings is no speakers. But NOVA-QRPers bring homebrew rigs aplenty, as well as every kind of current (and historical) kit built items. This young club already has at least one tradition: free empty Altoids tins (all flavors) for everyone. There have been lots of other give-aways as well: Last meeting there were free Radio Shack 0-15 volt meters in original packaging for everyone and a bunch of 16 volt, 2 amp transformers to go with them. Other meetings have featured great free stuff as well: BNC connectors by the box; mouse pads; crystals, and fistfuls of Schottke diodes. NOVA QRP has just received a club call, WA4MM, and is making plans for an all-band total all-out field day effort at Lake Fairfax Park in Fairfax County. With several finished and tested K-2's in the club and with several members in possession of portable masts and antennas, it should be awesome. For further information on NOVA-QRP, its meetings and activities, or to be added to the NOVA-QRP e-mailing list, send an e-mail to K4AHK@ix.netcom.com.

Little Thunder Bay QRP Club - Monday March 6th held a new page in the amateur radio fraternity inThunder Bay. A group of local QRP operators met at the home of Bill (VE3XT) to talk radio and show off some toys. These amateur radio operators built most of the QRP rigs that were on display. Those present at Bills' were: Wayne VA3WRL, Phil VE3AXL, Rob VE3FLB, Fred VE3FAL, and of course our host Bill VE3XT. Topics of discussion were antennas, radios, various reading materials and QRP clubs. Some of the items on display were: Nightsmite, Pixie II, Two Fer, MFJ 9420, OHR HPXVCR, 38 Special,

Bill also had QRP Quarterly magazines dating back to 1984.Other reading material was The 5 Watter(T5W) from Michigan QRP Club, QRP Homebrewer(NJQRP Club),and QRPp(Norcal). We are planning a QRP to the field test to happen in the very near future to try some of the rigs and antennas out, and see how they all compare. We hope to have meetings once a month and hope to have others from the amateur hobby of QRP. Some photos of the group and the rigs on display were also taken. Phil VE3AXL was the lucky winner of a years subscription to the QRP Quarterly, thanks to Mary, NA6E of QRPARCI. Looking forward to the next meeting.

Eastern PA QRP Club (EPA) - Hello Everyone, The Eastern PA QRP Club has created the Appalachian Trail Award Program that is open to all Amateur Radio operators. You can find the information at http://www.n3epa.org. Click on the link to HTML or Text and then click on the Appalachian Trail Award. I have recently updated the application forms for each award. Happy Hiking!

The Lake Perris QRP Society was started over a year ago by several hams in the Southern California QRP society who were camping out at -- you guessed it -- Lake Perris in Riverside, California. Our membership (such as it is) boasts only one person who actually is *from* Lake Perris -- and he's KF6NPN who is a park ranger working there. We are steadfastly opposed to any organization of any kind, have no formal roster, meetings, or (gasp!) dues. We do have a great time, however, by advancing the QRP cause monthly at the Cal Poly Pomona swap meet. We congregate, set up a station there, and regale all comers on the joy of QRP. It is surprising; by the way, how many people are attracted to an actual operating station at swap meets. Our informal ranks swell each month. After the swap meet, we head over to a local sports bar for lunch. The activities there include discussions of building projects or kits, planned outings, and even contests (we recently held toroid-winding contests for speed and accuracy). This lunch includes upwards of 20 attendees including regulars and visitors. Not quite NorCal's California Burger, but it'll do. If anyone is planning on being in the Southern California area on the third Saturday of any month, they are encouraged to contact K6WHP, William Phinizy, at k6whp@gte.net or k6whp@arrl.net and he will be happy to provide further information.

The Austin QRP Club (A QRP Club) - The Austin (TX) QRP Club was organized to allow those interested in QRP and building in Central Texas an opportunity to share ideas and experiences. AQRP meets the second Saturday of each month at 11 AM. All the details are available at our web site: http://www.qsl.net/kq5rp/aqrp.html. We have no real membership requirements. If you show up you are a member! We have about 60 on our email list and typically 10-15 show up at meetings. We have been thinking about a project. That's it...just thinking. We are planning a small QRP Field Day effort possibly with some of the Houston QRP group, and anyone else that shows up. Additional info from mailto:k5fx@arrl.net

QRP Cheeseheads: - A bunch of the QRP Cheeseheads group ventured out to the western shores of Lake Michigan where it was in the mid 40s with about a 20 mph wind. It was COLD! However, after doing FYBO in February, how bad could it be, right? The crew consisted of AE9K, N9AW, NK9G, W9XU, WA9TZE and KF0CT. We decided to each use our own calls to maximize activity for us and for all of you that participated. We shifted operators on three primary rigs every 30 minutes so everyone got their chance. We used two FT900s and two Argo 515s. On hand were a Wilderness Sierra and a homebrewed 40 mtr Ramsey receiver/transmitter combination. Oh, and a gaggle of batteries which we all agreed we need to trim down for the next event.....those babies are heavy. We got off to a little later start than we wanted to and the wind contributed to our delay. NK9G, our resident archer, had a tough time getting the lines shot into the trees with the wind and all but finally overcame that obstacle. For antennas we had a 20 mtr delta loop and a 15 mtr delta loop, points hanging down, both suspended on the same rope about 50 feet high. The other antenna was a G5RV at about 40 ft. Conditions on 20 and 15 were excellent. In fact, I would say 15 was in great shape for what is essentially a stateside contest. I couldn't believe the activity on 15 compared to just 2 weeks prior in the ARCI Spring QSO Party where all I could

us here in the midwest also but this time it was not so good. It's tough to tell if it was just propagation or the broken antenna lead at the center insulator we found with about 1.5 hrs to go in the contest. From what others have said it doesn't sound like we missed much on 40 though. Essentially we were using one half of a short 40-10 mtr G5RV, so that's about 26 feet of wire. The MFJ tuner did its job to tune it out with our 40 mtr station on one of the Argo 515s. With about 1.5 hrs remaining in the contest we decided to move 40 mtrs to one of the FT900s. When the 900 couldn't tune out the SWR. We knew we had more than just a bad propagation problem. Without any soldering capabilities we just made the best mechanical connection we could and went for it. Activity on 40 sure picked up after that. I really enjoyed myself despite the cold weather. It was fun being out with my QRP buddies and it was fun working so many stations that made the effort to get out into the field. Your enthusiasm is contagious.....keep it up. Amount of FUN had.....immeasureable

The Flying Pigs QRP Club International - KC8OCO was founded by Dieter Gentzow, WB8DIZ and Rick Powell, WB6JBM of SW Ohio in late summer of 1999. The club is for the enjoyment of Ham Radio, QRP operations, home brewing, and general fun. We are an open membership club with members from all over the U.S. and Europe. Everyone is welcome to join simply by sending an email to Richard, WB6JBM at ripowell@mpna.com. As the club motto states: No Dues, No Rules, Just Right! We operate 4Khz up from the standard QRP frequencies on all HF bands.

Club projects include the "MiniPig 10", a QRP transceiver for 10 meters designed by Dieter, WB8DIZ, and other projects are in the works. We have semi-regular club contests where FPqrp members try to work each other for prizes donated by club members. Plans are in the works to sponsor one or two sprint type events in the coming year. The club Web Page URL is: http://www.mpna.com/fpqrp/ We also have an email reflector for members at Egroups.com.

Front to back, L-R, Andy KC8KFI FP-8 and Rick WB6JBM FP-2 Dan N8IE FP-6, Dave KB8RRG FP-7, Diz W8DIZ FP-1 and John WA8KNE FP-60 (photo taken at Dayton 2000)

The North Georgia QRP Club continues to meet on the 1st Saturday of each month from 10AM until about 2PM or whenever we can get folks to leave. The RadioShack.com store 5600 Buford Highway Doraville, GA 770-936-7086 in NE Atlanta is our current meeting place and we generally have about 20-25 interested QRPers and want-to-bees show up for each meeting. Although we have no officers, no dues, no set agenda and no rules we usually keep things lively with a great show and tell session and a lot of good ham fellowship.

We still have NOGA members coming from up to 140 miles away so we must be doing something right. By the time you read this we would have had our June meeting at the Atlanta hamfest with QRP booths setup to show QRPers in action with real QRP gear. Last year this was by far the best attended to booth at the hamfest. We plan to have monthly meeting throughout the Summer (1st Sat in Jul, Aug, Sep) and hope if you're in the Atlanta area around the first weekend of the months you give someone a call or an email.

We try to keep our web page fairly current with activity info and club/member oriented projects so check it out at http://www.qsl.net/nogaqrp/. We have a slow speed informal CW net every Tuesday night at 0130 utc on 3.6864 mHz (a common computer xtal frequency) with everyone encouraged to use their QRP rigs particularly their kits and homebrew creations. Again as always it's informal and just fun. We are currently kitting the third hundred parts sets for NOGAPIG kits. This is the best $15 you can ever spend on protecting your rig. The web page has all the details. So call us, email us or work us on the popular QRP spots on the dial. Generally someone will be there during band openings. Don't forget the upper bands this Summer: 15/10/6 mtrs.

The Hawaii QRP Club continues to gather DAILY at Jack-in-the Box restaurant, mile 2 Volcano Highway, Hilo, mornings 8:30-10:30 a.m. March 2000 marks total 254 attendance, a new monthly record. We also encourage participation in the monthly tail-gate swap meet, third Saturdays.

Two important upcoming events: QRPTTF using club call AL0HA for Moku Ola Island, HI and Milliwatt Field Day using the memorial club call KH6IN from Laupahoehoe Point, HI.

Dean, KH6B, and Don , NH6WW, install the Hy-Gain 14 AVQ Trap Vertical at low tide on a tiny rock outcropping into the Pacific Ocean on the shore of Moku Ola Island during the Hi-QRP DXpedition there. Time to test the theory that salt water is GREAT groundplane. A pair

AZ ScQRPions: - Started by a small group of QRP buffs about 4 years ago, the AZ ScQRPions has managed to stay alive in Arizona, attracting 'members' from various parts of the country, and Canada. We meet monthly, if everyone remembers, and discuss the latest kits, contests and have a show and tell session where members brag on their latest projects. The serious, or most serious, part of the meetings revolve around the annual Ft Tuthill QRP Symposium, and how we are gonna do it again. We strive to outdo the other groups, which ain't easy, given the relative inaccessibility of the site. There are no mememembership requirements other than an interest in QRP. No dues, no officers, no formality. Anyone is welcome to join in, and, even if not located in AZ, can become a member by simply asking to do so. We try to get together for all the major 'field contests', and plan group operations when two or more of us can get together

Adventures in . . . Milliwatting

Jim Hale, KJ5TF
kj5tf@madisoncounty.net

Since the previous issue of ARCI QRP Quarterly there's been lots of interesting happenings.

The Second Leg of the Milliwatt Triple Crown CW contest sponsored by the Ft Smith QRP Club, has been run. The winner of the first leg was announced in the last issue, but by accident the second place winner was left out. Congratulations to John Marshall, KU4AF for the fine effort. As of press time, the results of the second leg haven't been announced yet.

In the second leg, I had the pleasure to be operator of Arkansas QRP Club Station, NQ5RP along with Carlin N5OE. His turn as station op was impressive to say the least. Bagging DX like LZ2RS/QRP(Rumi), UA9FGS, and UA4WEA, with his SST running 500mW.

Many QRP'ers like the way this event involves regional QRP clubs. The many QRP events put on by various clubs are always interesting, but by bringing in these other clubs it adds some extra fun to it. The lower the club stations power, the more bonus points they are worth. A 500mW club station is a cool 2000 bonus points, & 100mW is 4000, etc. The third leg runs July 14th, 15th, and 16th and is sponsored by IA QRP.

PSK31 & RTTY digital QRPp

By now most of you have heard about PSK31. This spring I upgraded my computer and it came with a sound card, so I knew I had to give this mode a try. My favorite mode is CW, and I had no other experience with digital modes, except for VHF packet. I read the QST articles, & visited a few websites and got all the help I needed. It was easy to find other hams running psk31 using the same rig as mine and this helped a lot. It's very important to understand how to setup your sound card components, and properly set volume. In my case, the Elecraft web page has application notes for hooking up the K2.

There is free software on the Internet, and its top notch. If you don't have internet access, ask a friend who does, choose a program and get it installed. You need at least a 486 computer, and sound card. But older machines might work with some of the DOS psk31 software. Once the software is installed you can "read the mail" pretty easily. Just connect a stereo cable between the computer sound card microphone jack, and your rigs headphone, or external speaker jack. Turn the AF gain low, and start the program. Follow the "Help" files, and "Read me" documents, and practice centering the program on a psk31 signal. Once you are semi skilled at centering on a signal, understand the software, and getting good print, your ready to transmit. Those help files I mention sometimes contain hints on how to connect computer and radio.

I went for the 4N25 Opto isolator in my PTT/COM port circuit. It was kind of fun scrounging and soldering the few parts and fitting them into the microphone plug, and COM port D connector. But a simple toggle switch is good enough to get you started.

When you first try a new mode the first QSO is one to remember. For me it was 3/20/00 on 10M, with an XE station down in Mexico. I started at 2w, then 700mW and finally to 10mW and he still had decent print.

After a few weeks on psk31 I learned about another digital mode that I could run using the sound card on my computer. I downloaded the free trial copy of TrueTTY and the hook up was exactly the same as psk31! On my first day operating RTTY, 3/31/00 I had a QSO with 5B4/UA9CDV in Cyprus. My power was "QRO" at 2 watts, to my 20M wire half square, up 20ft in the front yard.

In early April 2000 I tried TrueTTY in the EA RTTY, and SP DX RTTY contests, and was very impressed with RTTY & QRPp. On 20, 15, and 10M it was pretty easy to work nearly any DX I called with my K2 running 700mW. Naturally it takes decent band conditions, and catching the DX station CQ'ing with few or no callers.

Just recently I was amazed again by HF propagation with TrueTTY. On May 20th at 16:40Z I met Vilnis, YL2KF, on the 15M band. I started with him at 700mW. He asked me if I could reduce my power. My print stayed close to 100% down to 65mW. Even at 30 and 10mW he reported 75% copy. Vilnis was running a KW.

No doubt that PSK31, and RTTY are very QRP friendly, and they add a whole new flavor to the QRP stew. Enjoy and savor it all.

You can find links to several psk31 websites, and TrueTTY, & other digital modes on my websites "links" page. http://www.madisoncounty.net/~kj5tf/

Best of 73's, 72's and sometimes 71's! Jim, KJ5TF

SW

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Contests

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UPCOMING EVENTS

Summer Daze SSB Sprint	August 6
Fall Qso Party	October 21-22
Holiday Spirits Homebrew Sprint	December 3

My nickel's worth: The Winter Fireside SSB Sprint generated considerable discussion concerning power levels for SSB. Basically, QRP ARCI says you can run 10 W PEP for SSB while ARRL says 5 W PEP for SSB is QRP. The scoring table for our contest was based on a maximum of 5 W PEP which appears to be a contradiction. Starting with the 2000 Summer Daze SSB Sprint the scoring table will reflect a maximum PEP power of 10 W for SSB. I took the simple approach and doubled all the power values in the previous table. If you do run the higher power remember that ARRL will not consider you QRP at 10 W PEP. Might matter if you use the contests for ARRL awards.

Elsewhere in this issue is the announcement for the Fall QSO Party. Last year it was moved to avoid a conflict with PACIFICON. This year it is the same weekend as PACIFICON. I looked at moving it forward one week, but we would be competing with the CQ WW Phone contest and a 10-10 CW contest. By leaving it at the third weekend we don't have major competition from other contests.

I've received many a "thank you" for the contest certificates. As I said on QRP-L it was a group effort. The team consisted of Steve, W2MY, Russ, AE4NY, and myself. I received your summary sheets and logs, checked, sorted, and determined the winners in each state, category, and the over all winner. I sent this info to Steve who printed the certificates. He sent them to Russ who put them into the protectors, stuffed them into envelopes, and mailed them. All the errors were mine. The entire great printing job was Steve's. And all the labor intensive work of stuffing and mailing was Russ's. A big thank you to Steve and Russ.

Speaking of certificates, I'll take this opportunity to remind you of the certificate categories. The highest score in each state, province, or country gets one. The highest score overall, the highest score from a single band entry, the highest score from the low bands (160, 80, 40), the highest score from the high bands (20, 15, 10), and the highest score at each QRP power level all get a certificate. In the Fall and Spring QSO Parties the top ten high scores get one too.

The QRP ARCI contest web pages are up and appear to be working. Just a reminder that you still need to submit your logs either by e-mail or by regular mail if you use the High Claimed Scores reporting form. You get a reminder of this when you use the form. Additionally, the only way to get your score posted on the High Claimed Scores web page is to use the reporting form. The address for the form is http://personal.palouse.net/rfoltz/arci/form.htm. The address for the contesting home page is http://personal.palouse.net/rfoltz/arci/arcitst.htm.

In this issue are the results from the Winter Fireside SSB Sprint and the Spring QSO Party. They are sorted by state. The web pages will have them sorted by descending score if you would rather look at them in that manner. I'll put them on in July, the issue date of this QQ.

I made more than one mistake in the April 2000 QRP Quarterly. The biggest was mis-scoring the Aluminum Kings Team entry in the Fall QSO Party. This team consisting of N4BP, KU7Y, K0FRP, N8ET, and N0UR had a correct total of 13,218,194 points. Not only did they break the old record; they shattered it! The old team record for the Fall QSO Party was 3,456,865 in 1997 by the Four Corners Team of N4BP, AE4IC, and VE7CQK. Each team member had an individual score of over 1.5 million. A peak at Bob's (N4BP) log showed he had seven hours with rates over 30 per hour. Here is an excerpt from Bob's extended soapbox *"I almost lived up to the name, but my newly erected 402BA (40M 2el Yagi) turned out to be resonant at 7.275, slightly useless for the Party! So, it was still my 30 foot high dipole on 40M and 60 foot high wires for 80/160. ... I had two best hours of 38 Q's each. One was on 15 & 20, the other on 10 & 15. ... This one [the contest] will be hard to top." Yup, it sure will.*

QRP ARCI WINTER FIRESIDE SSB SPRINT 2000

The Winter Fireside SSB Sprint was held on February 13, 2000. Twenty five reports were sent in to the contest manager. That was up a bit from the sixteen of last year. Most folks reported enjoying the contest.

TOP TEN			
WA7LNW	69,825	WB3AAL	25,578
N5WU	45,969	K1QM	25,025
KB3WK	40,320	W3TS	20,900
W6ZH	36,792	W1HUE	20,900
NN5B	30,450	W2VE	12,544

CERTIFICATE WINNERS		
20 m	WB3AAL	25,578
DX	VE5QRP	7,462
High Band	N5WU	45,969

WINTER FIRESIDE SSB SPRINT SOAPBOX

N4JS - Very few SSB stations on contest. **N5WU** - Tried out K2 on SSB, tho. Lots of fun, however the bands were in pretty bad shape. My first SSB ARCI sprint. Matter of fact, my first ARCI sprint ever... **N2EI** - Fun Contest. Bands closed out a little earlier than I expected. The upper segment of 40 was occupied with some AMers so most of the activity was below 7285. Interesting to hear the voices of some familiar "fists". **K1QM** - Sure was nice to work a lot of the QRP folks on QRP SSB. I suspect the K2 has got a lot of the Mic's out... Thanks to everyone who responded to my CQ **WB3AAL** - Had a great time again on 20 meters. Thanks to all those fellow QRPers who I made a contact with on the heavy QRM bands. Sorry for the few guys I just could not pull out of the QRM & QRN. I hope the next contest the bands are in better condition. **WA7LNW** - Great to hear the SSB voices of so many QRP operators I have worked on QRP CW mode. Received excellent reports on my K-2 SSB signal quality... indicating... I must have constructed the K-2 SSB option correctly! Looking forward to future QRP SSB events where we can get outside in the field and use my K-2 this summer. Thanks to everyone for the nice contacts and short, but very enjoyable conversations! **W6ZH** - 15 was best band, followed by 10, 20 almost a wash-out, 40 2 Q's, zip on 80 or 160 - alas **KB2HSH** - I had a great time! 40 was interesting, as the broadcast came in, then the AM'ers...but all in all, activity was better than I expected. And as before, my 15 month old son, Aron, was amazed by the nifty voices coming from the speaker. Had lots of fun, and can't wait for the NEXT sprint! **W1HUE** - Nice way to spend a snowy sunday afternoon, even if band condition not so great. At least the score was easy to figure. **N4EUK** - Lots of QRM on 20 and 40, little activity on 10, 15 was the best band, by far. Would have liked to work more, but had to run. **NN5B** - My first ARCI contest had fun & met some nice folks. Let's do it again soon. Don't have the SSB in the K2 so had to cut the pwr down on the Yaesu **VE5QRP** - The perfect way to enjoy a Sunday afternoon even if only for a couple of hours....sure like doing SSB qrp - my first but not last ARCI sprint - tnx & 72 **W3TS** - Could only spend abt 1h45m in contest as I was taking XYL out to dinner for Valentines Day. **W2VE** - Enjoyed first QRP contest. **KB3AAG** - I would have much rather have been using my Index QRP+ but had a stroke in Dec and lost my left hand and arm. Bob Heil says there is no way to get his boom set to key the rig and as I need the right hand to log, drink coffee, and smoke cigars I had to pass up using it. Oh by the way, the lack of capital letters in this is due to one handed typing. My first QRP contest and I enjoyed it. [Ed: I've corrected the capital letters.] **K7NTW** - Just finished building rig day before contest. QSOs were the first QSOs on it. **K3CHP** - Surprised at low turnout; poor conditions and severe QRN added to the struggle. **NN5B** - My first SSB contest (only one other contest - on Field Day in 1998 as single op, battery, CW, QRP). **KI0II** - Found a fair number of operators on 10 meters, but most were not QRP or contesting. Made some good contacts anyway and spread the word that QRP does work. Nice to work a few ARCI folks and hear the voices. Very enjoyable. **KB3WK** - Enjoyed the contest. It was my first SSB contest with the K2, and I thought it did extremely well.

QRP ARCI SPRING QSO PARTY 2000

Conditions for this contest on April 8-9, 2000 were a bit tough, as many commented on and most everyone noticed. The solar flux was 180 with an A-index of 17. The solar flux was on our side, but with that high an A-index the bands were noisy. Scores were a bit off from 1999 when the top six folks had more than one million points compared to only the top three this year. About the same number of folks sent in reports. We had several DX stations participate which really added to the fun. One of the DX entrants (GW0VSW) was a two time World Radio author. Carl's most recent article about a QRP DXpedition to an African island appeared in the June 2000 World Radio. Take a look, if you've still got it around. Another noteworthy accomplishment was by VE3SMA, Steve. He did the contest with a total of four transistors, two in his 40 m homebrew transmitter and two more in his homebrew receiver. His efforts were good for fourth place in the 40 m only category.

Editor's note: The scores for the "no name team reflect only N5IB. K0EVZ's logs were lost in the mail and arrived late and I forgot to send my score in...thank goodness for Jim or we would have had no score ...de NA6E

TOP TEN	
N4BP	1,755,292
N0UR	1,227,744
K7RE	1,202,782
N9AW	981,190
N8ET	792,442
W4DEC	632,492
NQ7X	598,878
K1QM	549,626
N2CQ	539,448
K4BAI	536,844

TEAMS		
Aluminum Kings	N4BP, N0UR, N8ET, K8DD, K1QM	4,325,104
QRP Cheeseheads ARC	AE9K, N9AW, NK9G, WA9TZE	981,190
NJQRPeaNUTS Teama	N2CQ, W3BBO, N2CX, AA1MY,	902,328
Eastern PA QRP Club	WB3AAL, N3AO, K3ZX, WA3WSJ,	650,447
WQ4RP	AA4XX, AB4PP, AE4IC, WF4I,	368,298
No Name Team	NA6E, K0EVZ, N5IB	40,936

CATEGORY WINNERS						
40 m	K9PX	250,432		Low band	N4ROA	216,660
20 m	WA4DOU	178,500		LT 5 W	N4BP	1,755,292
15 m	K6III	36,400		LT 1 W	W3TS	461,700
10 m	WX7R	46,648		LT 250 mW	K2JT	377,400
High band	K7RE	1,202,782				

2000 Spring QSO Party Soapbox

AF4PP - Lots of fun!! First time I've ever submitted a log hope its right. Looking forward to next ARCI event. **W2BVH** - With an L-C IF filter (500 Hz) chaos reigns! **KA1DDB** - Operated mostly search and pounce. Used ScQRPion QRPDUPE logging program, which was a big help as compared to the manual logging and duping I did in the past. Thanks to Brian, K7RE, for providing the program for all to use. **AB5XQ** - My first QSO Party - not very high score but I had a great time! **WC4CW** - Operated portable from campsite #8, Modoc Campground, Clarks Hill Lake, SC. **W8TIM** - 40 m band was a real yo-yo, but enjoyed the contest as usual. **W2BVH** - With an L-C IF filter (500 Hz) chaos reigns! **W3MWY** - Where were they? I mean, of course, those stalwarts from IL, MO, IA, CO etc. that I looked for as in the past. Even the Golden State lads were not heard as I had anticipated on 20/15 m. Forty was noisy all during the contest. Fifteen & twenty seemed almost dead a lot of the time and is why I seem to have jumped around so much. How many of the crowd worked LY2FE/QRP who tried his luck in our contest? But all in all, a great contest that was fun that left me sorry that I could not have stayed a few more hours. **K5HQV** - Saturday conditions were less than spectacular. 80 was a real bust - high levels of QRN. 40 and 20 were plagued with deep slow QSB most of the weekend. Just not many stations on 15 or 10 m, at least at this location. Always fun! Guess spring had everyone in the yards. hi hi. Looking forward to Fall 2000. **K1QM** - Lots of QRN Sat and till 2pm Sun. Sun afternoon got better. All signals weak. **K2JT** - Brutal conditions Saturday night on 80 meters. Great fun to copy stations at the noise level. The "FISTS" & "data" mode stns are squeezing us on both sides of the calling frequencies. **N1EI** - The only band really open on Saturday was 40m. Conditions improved some Sunday. **GW0VSW** - I had just got out of hospital last week having suffered a collapsed lung with orders from the doctors to "take it easy". However, it enabled me to get on the radio and operate in this years Spring QSO Party despite and aching side, Hi. Band conditions were not so good here on Saturday with high levels of local QRN and several other contests all fighting for band space. However, 10m picked up later Sunday afternoon with some good signals coming in from members stateside. I enjoyed the contest but was glad to call it a day and get some rest! **W2JEK** - Not much time to QSO - busy weekend. **KB8YUC** - My first real stab at contesting. Vy fun. **W3TS** - Ruff conditions for 250mW - Cqing was very unproductive. **N4ROA** - Finished the ATU for the K2 just in time. Fantastic! Thanks to all that dropped by. **W5TB** - Operated from banks of the Buffalo National River - felt more like FYBO :) **N9AW** - Poor condx to start. Low activity on 10 and 15. Good contest as always, had lots of fun. **N2QO** - Another great contest with good conditions. It is nice that TR-Log lets you send real signal reports, not just 599. I couldn't operate for too long as I had the PE exam to study for. **WA2BQI** - Great contest - poor condx on all bands! Had fun! Next time GL. **K8NI** - My first ARCI 'test. **K3NVI** - Band condx were poor this year (80 m esp) but "wow" surprised out-of-no-where got 4X6PT! DX! **N4UY** - Lots of fun, as usual - nice to know an indoor antenna will work. **WX7R** - Lazy H antenna used on 90% contacts. Much quieter than yagi! Also, more QRPers need to try 10 m! It was open to east at least half the time. **WB0SMZ** - Lots of strong signals. **W0UFO** - Lots of fun. Wish I had more time. **K0ZK** - Highlights for me: working W7ZOI after many years. I used to sked him on 160 QRP when I lived in Colorado 20 years ago. QSOs with AL7FS and KM6U back to back, 600 mW OH9VL vy weak but genuine QSO. Very good activity from ARCI membership for many x5 QSOs. **KB1CKS** - It is amazing how some of these QRPers dig the signals out of the mud. A great contest. **W2QYA** - Power output measured with Radio Shack pwr/SWR meter calibrated by me with a Heathkit VTVM measuring RMS into 50 ohm non-inductive load. **W2XS** - Wish I had started sooner. But had fun. **NQ9RP** - First QRP contest in a "long time" - enjoyed it "a lot". Will also be in the QRPTTF 2000 water contest April 29, 2000. **VE3SMA** - Amazing to be able to copy milliwatt stations like W3TS and W9JOP/4 with a two transistor receiver! **N0RC** - I enjoy these low-key contests/parties and always make an Effort to participate. Great OPS and great fun. Got my first ever HI QRP contact in this event! **KM5VY** - First contest, it was fun and I'll probably try again. **N9SD** - My first time trying this contest. Went single band on 10m. Pretty slow here in the midwest, but I slogged along. **N5OBC** - Finally worked a contest on CW. Great to work all you good ops. Thanks to all who heard my 1 watt signals. Worked 22 states plus AB Canada. This has really helped me with my cw skills and I'll be back for more...The contacts on the way home from Arkicon were a hoot, me working cw from the truck, old bunnell key strapped to my leg K5AM were you in NM Saturday or did I mess up my log? Did not count the contact anyway :) Thanks to all **N9MZP** - Band Conditions were poor/noisy **WA3WSJ** - I was drafted by the EPA Dictator! I had lots of fun the short time on the air. **KK4R** - Didn't have much time for this one, but managed to run into the radio room for a few short periods. That turned out to be a good way to work the party. About the time I was running out of new stations to work, it was time for the next honey-do. **N9AW** - Condx were pretty rough at beginning of contest with the solar storm we had but got better as time went on. 10 and 15 mtr activity seemed very light - where was everybody? 40 and 20 very good. 80 so-so, too noisy. Nice to see everyone having QRP fun. **AD6JY** - This was my third try at a qrp contest. The band conditions made this one a truly humiliating experience. I felt like I was trying to hear the contest from the bottom of a deep hole with ear muffs on. I knew there were stations out there, but I couldn't hear them and my CQ's often didn't seem to be able to get out of the hole either. It was still fun, especially the satisfaction of copying the exchange from really weak signals on noisy bands **NQ7X** - Great participation by bunch of A1 ops. Wish I had more time to operate. Surprised to have 3 European QRP stations answer my CQ. Thanks ARCI. **WR4I** - Great time trying out my new K2 for a contest! Good running into old friends. Wish bands condx would have been better for 20/15. **JR0BAQ** - Tried again the QRP contest from Japan! Great fun and very glad to make contacts to many QRPers **WE6W** - Did ok for a west coast station. 40 and 20 M were weak here. Had a great time. **N5IB** - Rotten conditions in Louisiana. Cool dry weather brought return of local line noise as well. Worked just about everyone I heard, but didn't hear many. Only plus mark is this (low) score beat by Fall effort. **K7RE** - All op's did well despite fair to poor propagation. I had hoped to enter the top 3 band category, but don't see it listed this year. Gang is getting better and better each contest at operating. Thanks to the great ARCI contest folks who make it all happen each year! **W3BBO** - Lousy band conditions! Lousy weather conditions - it was snowing Great Operators - thanks for all the contacts **KS4DU** - Operated from Modoc (SC) Campground, Site #8, on the windy (40+ mph steady) shores of Lake Thurmond. Saturday afternoon was a real wild ride as close to hurricane force lake wind gusts kept the camper dancing and shaking for over six hours. I mean, I was SCARED. That was some cold-front that came through! However, the antenna stayed up, along with all the trees in my general vicinity. Thanks to all the fine QRP ops out there. Big Sig award goes to WD0T. Highlight was having W1FB come back to my CQ. **NL7Z** - My first qrp contest - much more fun and productive than I expected. I had a good time and plan to put in more effort next year **AD6GI** - Learned a lot about 15 M;had too many non-contest tasks to do dedicate solid time; great fun and many excellent operators. Thanks to all for their patience and to ARCI for another great contest! **N3AO** - Great Fun! **WT9S** - I was only able to get on for a brief time, but had fun trying to work folks in the strange band condx. Looking forward to FDIM and the Hootowl! **AB8DF** - Spent most of Saturday helping a new General put up his first HF antenna. Kinda cool when his first QSO was with a RA4 on 15 meters SSB. Not QRP but I am working on him. **N0RC** - Another great QSO Party, despite band CONDX. Worked 35 states including first ever HI QRP contact. **W1VT** - Great contest, even though the 40M ant was damaged by high winds--33 more ARCI members-- up to 983! Pleased to get OH9VL for country #53 for 2xQRP DXCC. **N6WG** - I chose to do a single-band effort on 40m this year. Turned

out to be a bad choice. 40m was pretty much a ghost town most of the time. Averaged just over 3 QSO per hour. Ugh! Well, onward and upward. 72, all. **WB8RCR** - Crummy condx, didn't work real hard at it, but had fun. Also a chance to wring out the freshly built NC20. Making a special QSL card for the event - it will be a rare one given the number of Q's I made :-)) **K5NZ** - Tried to increase on my WAS 70mW. Thanks to all those that dug me out of the mud, condx were stinko for 5 wts, imagine 70mw! **N1EI** - Only 40M seemed to be really open on Saturday. Conditions improved Sunday. **K5HQV** - Conditions generally were not to swift. Fewer than normal stations on and generally pretty weak here in Central MS. 80 was a complete bust with bad QRN. Maybe better in Fall. **AF4PP** - Great fun. Already looking forward to the next event. **AA1MY** - Going from flowered spring to 4" of blowing snow in 24 hrs is something I won't forget! Poor ant condx at home so op from secret site 'cross town. 90' cf dipole (E.D.Z.) and a low 20m dipole at 90 deg for N-S Q's. Had Op in back seat of car.(First all-QRPp event) "senior moment" at first, -gave my QRP-L number instead of my ARCI number, but they copied so I hope that's o.k. Froze m'butt off Sunday -only day I had real time to operate. Good time tho, observing weird propagation pop-corning all over the continent. QRPp isn't highly effective in a poor propagation contest situation. I can understand this now, esp. after having my ears blown off by QRO and strong QRP sigs for a couple of hours. You just can't risk your ears for the weaker ones if you don't have AGC. Seemed like lots of ops just had no ears at all, sometimes. Logging on paper draweth mightily. Lost a few in confusion of back/forth key/paper in pileups, illegible entries and hypothermia. Couldn't keep a functional dupe sheet in such cramped condx. Must get that POQET Sr power supply repaired and a functional logging program on it. **WQ4RP** (op KO4PY) - Five of us worked from Falls Lake in NC. We had a blast, plus unexpected visits from a very nice blacksnake and a not so nice tornado, which required evacuation of our campsites to an emergency evacuation area for part of the contest. Still was a lot of fun. **W4DEC** - Great to work LZ2RS,ZA1MM and LY2FE and so many of the gang from QRP-L **AL7FS** - Greetings from Alaska. It was a real treat to work LY2FE and UA1DW in the contest. Conditions were very bad for Alaska but not as bad as two years ago. I had to wait for the signals to fade up so I could work a few, then it would fade out and there would be no signals on any QRP segment of any band. In 15 minutes to and hour it would be back. My log times show the ups and downs. Later the cycle seemed to shorten to 5 to 10 minutes. The whole contest was fun and I appreciate all of you who listened for me. Thank you. **AE4GX** - Lots of fun for a short time operating. My highlight was working Dave/W1FB on 20 mtrs. Looking forward to next event. **WA4DOU** - Conditions were poor compared to Fall 1999 QSO Party **KB7WW** - Need to cure my local 40 meter QRN maker it was over S9 for hours. Might have to try the OTT-6 on it. Thanks to all who were there to just pass out points. **W1FB** - Wish I could have spent more time in this one. Great operators and lots of fun. **KG4BIG** - Next time hope to be able to put in more time. **N8ET** - Conditions were lousy, but did work some good DX. 10/40 meter beams would not turn one direction for a couple of hours Sunday, so they wound up pointing south (and I had already worked N4BP!) ! **N2CQ** - The activity seems down this time for some reason. Mine was too due to unusual activity at the home QTH. Glad to hear many if the "usual suspects" though! **G3XJS** - Thanks for the FUN. Conditions strange, but delighted to hear and work some of the harder (for us) States in the West. **N7AC** - Got my ARCI number after contest had started so I didn't use it. I made 47 contacts, 39 who were ARCI members. Hope I did the calculations correctly. **K8CV** - Propagation stunk and we had a heavy spring snow storm. **N0UR** - We had to work this time, strange condx. **KF8EE** - Quite interesting conditions on the higher bands due to the major solar storm that went through that week. I managed to hear G3XJS working some stations on 20 meters, but never got him in the log. A very nice contest as usual. **OH9VL** - Very nice signals once more, will see you in next ARCI contest. **K2QO** - Another great contest with good conditions. It is nice that TR-LOG lets you send real signal reports, not just 599. I couldn't operate for too long as I had the PE exam to study for. **WB3AAL** - I had a lot of fun after I solved my keying problem. Wish the conditions were better. **WA4DOU** - Have always enjoyed the QSO Parties. Hope to have the station construction completed by fall, in time for a more serious effort!

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The photo on the left is Fred Behrman, K7LNS, QRP AARCI member number 562. I thought I'd share the cartoon below that Fred sent me with all of you. It's from the Southwest QRPer Jan/Feb 1983.

de Mary, NA6E

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(With thanks to **L.B. Cebik** for all his help)

de Mary, NA6E

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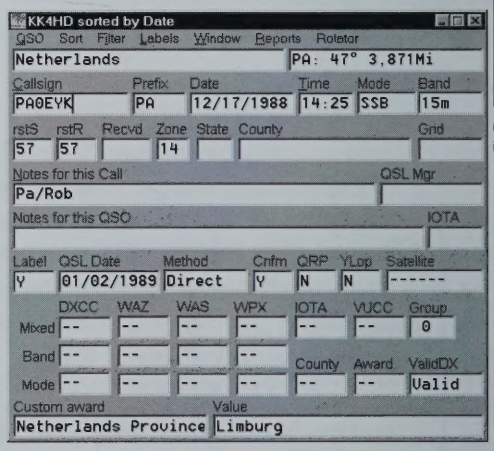
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